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O. P. BRYSCH, Editor — P. J. CHATTA, Assistant Editor

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1. MANAGEMENT

Federal Power Commission

Gas Curbs Here to Stay, IPAA Told. *Oil Gas J. 58,* 57 (1960) Oct. 31 (3 pp.)

Resolution adopted by the Independent Petroleum Association of America (IPAA) studiously avoided any mention of the Federal Power Commission's (FPC) area-pricing approach. Neither did it suggest any compromise with the objective of completely freeing field prices from all regulations. Approach taken by the FPC is one which has always appealed to transmission men as offering the most promise of being workable. If oil and gas prices are allowed to equate on a Btu basis at the wellhead, the economics of the gas industry are such that gas cannot come anywhere near competing with oil and other fuels at distant consumer points. Therefore, distributors will insist on some supervision of gas prices wherever there is not free play of competition in the market place.

Why Fight It? W. W. Gatchell. *Public Util. Fortnightly 66,* 696 (1960) Nov. 10 (7 pp.)

Gas producers are hitting their heads against a stone wall in fighting regulation, writes the author. Courts today seem generally price-conscious and in no mood for relaxing regulatory controls. Price is a more important factor in certificate cases due to the famous U. S. Supreme Court Catco decision. Rate cases have been speeded up by the FPC, but reasonable rates are not always easy to ascertain. Caught in the web of court decisions and governmental controls, producers might fare better were they to comply with, rather than fight, regulation.

Gas Industry Expansion

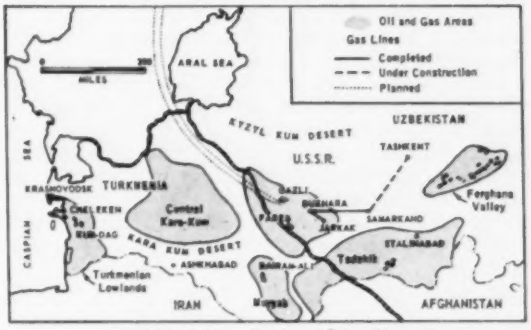
The Gas Industry in the U.S.S.R. L. L. Newman. *Gas 36,* 59 (1960) Nov. (7 pp.)

Author served as a member of the Minnesota Peat Mission to the USSR in 1957. Article is prepared from notes accumulated during that visit, supplemented by a variety of articles in the technical press. Author first points out that the gasworks in Moscow and 10 larger cities were built during the period 1861-82. Development of Soviet gas industry is typified by growth in consumption in Leningrad, from 1.5 MMCF/day in 1913 to about 78 MMCF/day in 1956. With this increase of consumption in the Soviet, the industry has expanded. For example, a new shale plant, with an output of 60 billion CF will be completed by 1962; there are over 200 proven fields of natural gas in the Soviet; more than 30 pipelines ranging in diameter from 10 to 40 in. and in length from 100 to 800 miles are in service or under construction; and a liquid methane liquefaction and storage plant has been in operation near Moscow since 1954.

Gas Industry Promises Revolutionary Change Then . . . Major Advance. P. J. Savage. *Gas World 152,* 578 (1960) Oct. 22 (5 pp.)

Account has been given of various developments and problems which have been encountered in recent years

"Third Baku":
Huge Reserves in Central Asia



(Adapted from *Soviets Claim Huge Reserves . . .* see Abstract, p. 247.)

at Bromley-by-Bow works (Great Britain). Some of the items included represent straightforward works problems which would have arisen in any event. A good many others are related to the new plants built to utilize various oil fractions which have recently become available at economic prices, including: 1) refinery gas reforming plant at Romford (36 MMCF/day); 2) catalytic oil cracking plant at Romford, Fulham and Uxbridge (16½ MMCF/day); 3) conversion of the majority of conventional C.W.G. plants for P.F.D. carburation and reformation; and 4) butane/air plants at Beckton, Bromley, Fulham and Nine Elms.

Is the Worst Over? Wall Thinks So. *Oil Gas J. 58,* 69 (1960) Oct. 31.

Drilling will pick up, investment will rise, and prices may well become firmer, predicts E. E. Wall, president of California Oil. He points out that many who have discovered new fields have found that it is difficult to sell substantial quantities of the oil, even at cut-rate prices. They have, however, been a factor in the market. He adds that because of this, the so-called boom days of foreign oil appear to be over.

Gas Industry Management

As Others See Us? E. G. Stewart. *Coke and Gas 22,* 443 (1960) Oct. (6 pp.)

Author discusses a recent publication in the transactions of the Institute of Geographers, entitled "Recent Changes in the British Gas Industry," by G. Manners. While paper is primarily a study in applied geography concerned with the changing geographical disposition of gasworks and other sources of town gas resulting from nationalization, it also touches on present and future policies of the industry. In evaluating the paper, author believes that when Manners leaves the realm of geography, it loses in value because the views may be based upon too narrow a field of information.

Industry's Deficit Over Two Million. *Gas World 152,* 532 (1960) Oct. 13 (9 pp.); **Financially Disappointing, Technically Promising.** *Gas J. 304,* 85 (1960) Oct. 13; **The Biggest Loss Yet.** *Ibid., 85;* **Crisis Develops Fast For Gas Industry.** R. Kelf-Cohen. *Gas J. 304,* 167 (1960) Oct.

26 (6 pp.); **In Terms of £sd . . .** *Ibid.*, 176 (1960) Oct. 26 (3 pp.)

During the year the gas industry (Great Britain) had a deficit of £2,376,521, as compared with £1,466,882 the previous year on a gross income of £389.1 million (£389.6 million). Six Area Boards had surpluses and six incurred losses. So states the Gas Council annual report. Total income from gas sales was £224.9 million (£225.6 million); from coke and breeze sales, £80.2 million (£88.1 million); from other products, £20.8 million (£21.5 million); from sales of appliances £45.4 million (£37.0 million); and from other sources, £17.8 million (£17.4 million).

Appliances

Gas Appliance Center Spurs Industry Cooperation. D. Hale. *Am. Gas J. 187,* 42 (1960) Oct. (5 pp.)

Gas Appliance Center in the Dallas (Texas) Trade Mart is a unified gas industry exhibit on a year 'round basis that has brought a new concept to gas industry appliance promotion and intra-industry cooperation. Dealers, distributors, builders, architects, utilities, and manufacturers like it and use it. In first year of operation, GAC is already a sound business venture.

Cost Accounting

Freight Rate Equations. H. L. Thompson, *Ind. Eng. Chem. 52,* 44A (1960) Nov. (6 pp.)

Transportation costs can make the difference between a profit or a loss. Industries that shop large tonnages of low unit-value products confront freight rate problems at every turn—plant and warehouse location, freight absorption, regulatory agency relationships, and so on. Article presents time-saving approach to ensure a profitable decision.

Competition

10 Ways We Fail to Meet Electric Competition. C. C. Turner. *LP-Gas 20,* 18 (1960) Nov. (4 pp.)

Author cites ten reasons why he believes that electricity is making inroads upon markets where they should be blocked by gas. He says that LPG industry is: selling price, not performance; ignorant of competitor's prices; failing to adjust price to meet competition; failing to capitalize on competitor's handicaps; reluctant to point out competitor's lies; aiding and abetting competitor; doing a poor job of advertising; fighting among themselves; making disreputable gas installations; and ignoring means of cooperative effort.

Why Electric Househeating Falls Far Short of Claims. D. F. Hansen. *LP-Gas 20,* 13 (1960) Nov. (4 pp.)

Gas industry is faced with this challenge, says author: the presence of a giant electrical industry searching for an outlet for excess generating capacity. Through massive obtuse advertising, they are trying to leave the impression electric heating is modern, logical and better. Their advertising is geared to overcome their weak points, and, he says, they do have weaknesses. Basically, electric heating can be readily outperformed by gas, in both comfort and value—and gas gives a bonus because it costs less.

Drilling

Jersey Research Attacks Drilling Costs. L. A. Murphy. *Petrol. Eng. (Drilling and Producing) 32,* B-36 (1960) Oct. (4 pp.)

Review of basic and practical research in drilling carried out by the Jersey Production Co., Tulsa, Okla. Company conducts research for such Jersey Standard affiliates as the Carter Division of Humble Oil & Refining Co., Creole Petroleum Corp., Imperial Oil Ltd., International Petroleum Co. Ltd., Standard-Vacuum Oil Co., and Esso Standard (Libya) Inc.

Fire Safety

Extinguishing Agent Developments—A, B, C, Dry Chemical Extinguishers. G. E. Manning. *Quarterly Nat. Fire Protect. Assoc. 54,* 151 (1960) Oct. (3 pp.)

For many years, the fire extinguisher industry has been trying to develop an extinguishing agent which would be suitable for all of the common types of fires; that is, fires in ordinary combustible materials such as wood and paper (Class A), those in flammable liquids (Class B), and fires in electrical equipment (Class C). Recently, efforts have been intensified in the field of dry chemical, which seemed to hold the greatest promise as a so-called "all-purpose" extinguishing agent.

Extinguishing Agent Developments—Carbon Dioxide Extinguishment Tests. E. W. Cousins. *Quarterly Nat. Fire Protect. Assoc. 54,* 164 (1960) Oct. (9 pp.)

With a given nozzle design at a fixed height above the hazard, it was found that extinguishment depended on only three factors: 1) area covered per nozzle; 2) weight-rate of carbon dioxide application; and 3) velocity of the carbon dioxide through the face of the nozzle horn.

Extinguishing Agent Developments — Recent Navy Research on Dry Chemicals. R. L. Tuve. *Quarterly Nat. Fire Protect. Assoc. 54,* 158 (1960) Oct. (6 pp.)

Tests conducted over a five-year period at the U.S. Naval Research Laboratory and the results of other experiments proved that if dry chemical was to be used with complete safety in fire-fighting operations where foam is the primary defense against fires in hydrocarbons such as gasoline and jet fuel, then the dry chemical must be completely free of stearates or other foam destroying materials used as coating agents.

Extinguishing Agent Developments—Special Dry Powder Extinguishing Agents. E. D. Zeratsky. *Quarterly Nat. Fire Protect. Assoc. 54,* 154 (1960) Oct. (4 pp.)

Special dry powders have been developed to deal with fires involving combustible metals and certain highly reactive flammable liquids. These powders frequently are the only extinguishing media available to handle these materials. It is important to know the conditions under which each is effective and any limitations on their use. The metal or liquid, the quantity, the physical form, and the nature of the hazard, must all be con-

sidered when selecting the proper dry powder and the method of application.

Extinguishing Agent Developments—Testing of Fire-Fighting Foams. L. E. Rivkind. *Quarterly Nat. Fire Protect. Assoc. 54,* 139 (1960) Oct. (12 pp.)

Discussion is limited to the general class of mechanical or air foams regardless of other qualifying categories, and more specifically to a consideration of the testing of the foam in place, some of the problems encountered in such testing, and an abbreviated report on some of the results obtained in laboratory studies. Simply stated, foam should be capable of being placed on a burning fuel surface to effect a complete and continuous cover that is resistant to all the destructive conditions to which it will be exposed. The properties related to foam placement, which may be called the tactical properties, are expansion and fluidity or viscosity.

Foreign Activities

Argentina Opens Reserved Oil Areas. *Oil Gas J. 58,* 113 (1960) Nov. 7.

Argentina's President Auturo Frondizi recently issued a decree opening exclusive YPF preserves to private development. The controversial move, which had been fought by the state oil agency and nationalistic faction in government and the armed forces, will open the southern flank of the Comodoro Rivadavia producing area to private firms, both local and foreign. The 3000-sq mile area is the chief area of YPF operations and the source of some of the country's most prolific production.

Soviets Claim Huge Reserves in Desert Area. *Oil Gas J. 58,* 71 (1960) Oct. 31 (2 pp.)

"Third Baku" is the name given a vast, arid region east of the Caspian Sea lying to the north of Iran and Afghanistan. Soviet geologists believe this area has reserves comparable to those in the original Baku, on the western shore of the Caspian and in "Second Baku," extending from the Volga River to the Ural Mountains. Factors that point up Russian hopes are: new gasfield at Gazli, Uzbekistan, believed to be the largest in the USSR and possibly in the world; reserves comparable to those of Saudi Arabia and Kuwait; feasibility of petrochemical and refining centers as large as those in the Caucasus and in Second Baku areas. Uzbekistan Republic's total gas reserves are estimated at 53-71 trillion CF. Turkmenia's gas reserves are estimated at about 92 trillion CF.

A Statistical Review of Pakistan's Oil and Gas Industry, 1948-1960. Supplement to *Progress 5,* (1960) Aug. (4 pp.)

During 1947-60, almost 100 wells have been drilled in Pakistan to a depth of about 700,000 ft. Result: nine gasfields with proved reserves of 12 MMCF and three oil pools which have increased indigenous oil production by some 500%. Maps and statements on gas and oil are presented.

World's Second-Biggest Gas Field Seeks a Market and a Means of Getting to It. E. Rerolle. *Oil Gas J. 58,* 92 (1960) Oct. 31.

Reserves in place at Hassi R'Mel natural gasfield, Algeria, have been evaluated at 1900 billion CM, with exploitable reserves about 800 billion CM. Estimates are that field will produce for 50 years, with production at 20 billion CM/yr. Field will be utilized fully only if methane from the Sahara can be disposed of overseas. Proposed solutions include transporting methane at very low temperatures and pipeline routes across the Mediterranean.

LPG

BuMines Report: 1959 LPG-Ethane Sales Neared 9 Billion Mark. *Butane-Propane News 22,* 65 (1960) Oct. (2 pp.); **Domestic LP-Gas Sales Increase by 20 Percent.** *LP-Gas 20,* 28 (1960) Nov. (2 pp.)

Domestic sales of LPG and ethane jumped 20% in 1959, according to a recently released annual report of the Bureau of Mines. This was the best gain in the past five years. In 1958, sales had increased 8%; in 1957, less than 5%; in 1956, 8%. This was the first year that ethane was reported separately. However, its effect in the total picture was not too great, since it only accounted for 8.8% of all LPG sales. Total sales in thousand gallons equaled 8,919,161. Sales of LPG in Alaska were included in the U.S. total for the first time. The total figures, broken down according to use, show that the sales in thousand gallons were distributed: domestic and commercial, 3,934,792; internal combustion, 889,698; industrial, 439,200; refinery fuel, 136,830; gas manufacturing, 182,903; chemical, 2,525,910; synthetic rubber, 513,941; used in the secondary recovery of petroleum, 231,134; all other, 64,753.

Maintenance

Refinery Maintenance . . . What It Costs. *Oil Gas J. 58,* 100 (1960) Oct. 24 (2 pp.)

Refiners began reducing maintenance costs in 1958, when economic conditions forced a trimming. The philosophy used in the reduction was that labor and material costs are related. When labor costs are cut, material costs decrease also. Refiners hastened to make personnel cuts and put off any work that could be postponed. However, if postponed maintenance is not done sooner or later, unscheduled shutdowns and higher work loads occur. The only way to keep the refinery's maintenance costs at low levels was to raise maintenance efficiency.

Pipeline Construction

European Pipelines—Planned on International Basis. F. C. Livingstone. *Pipeline Eng. 32,* D-46 (1960) Nov. (4 pp.)

Survey is intended to give a brief but complete picture of what Europe is doing to ensure that all countries west of the Iron Curtain receive an adequate supply of oil to maintain the industries of the individual countries and, if necessary, the defense forces of West Europe as a whole.

Global Aspect Steps Up Pipeline Pace. F. H. Love. *Pipeline Eng. 32,* D-20 (1960) Nov. (11 pp.)

Annual construction report, based on data supplied by operating companies and the controlling agencies in countries where the petroleum industry is nationalized, reveals that (for the 12 months ending October 1) pipelines completed or still under construction total 31,376 miles. This is compared to 22,415 miles a year ago. Total miles of gaslines constructed this year throughout the world is 17,895; product pipe mileage is 5673, and crude is 7808. A year ago, the figures for each category were 16,492, 2781 and 3152 miles, respectively.

Good Year Shaping Up for Canada. L. O. Rowland. *Pipeline Eng. 32,* D-38 (1960) Nov. (6 pp.)

Although natural gas main transmission and lateral construction was far below 1959, and even farther below the record-breaking 1958, it still managed to total more than double the mileage of oil lines. An approximate total of 766 miles of gaslines was laid during the summer. The only big-inch job of the year was 50.7 miles of 30-in. gasline in southeastern Manitoba, comprising the export lateral of Trans-Canada Pipe Lines, Ltd. In Alberta, the biggest item, and largest across Canada after the Trans-Canada job, was the main line extension of The Alberta Gas Trunk Line Co., Ltd., 72.5 miles of 24-in. pipe from Torrington Junction, in the west central part of the province, to the Homeglen-Rimbey gasfield, 75 miles southwest of Edmonton. Laterals added 110 miles.

Highway and Right-of-Way Conflicts and Problems. B. A. Towl, Jr. *Gas Age 126,* 42 (1960) Oct. 13 (4 pp.)

Potential problems arising from the 41,000-mile national system of highways authorized under the 1956 Federal-Aid Highway Act are indicated in the fact that this network will be superimposed upon some 2,800,000 miles of rights-of-way owned by some 30,000 public and private agencies. Author lists and discusses the steps taken to provide liaison between highway officials and agencies and the rights-of-way holders.

Reformed Gas

First of Its Type in Britain. *Gas J. 304,* 119 (1960) Oct. 19; **New Wales Grid Is Inaugurated.** *Gas World 152,* 565 (1960) Oct. 22.

First of its type in the British Isles, a 2½ MMCF/day Simon-Carves Otto catalytic reformation plant, has been officially opened. In his address, J. E. L. Martel, chairman of the Guernsey Gas Light Co. Ltd. said that gas had been produced from coal for the past 130 years but economic reasons made it imperative to switch over to butane. The new plant is entirely automatic, and for people living in proximity to the gasworks it would mean that at least they would be free of the nuisance of dirt and grit.

Safety

Acute Intoxications from Carbon Monoxide and Especially from Town Gas. *J. Ind. du Gas 84,* 386 (1960) Aug.-Sept. (4 pp. French text.)

Observations analysis recorded in the thesis for doctor's degree of medicine ready by Dr. Michel Bertin earlier this year, and extending on the survey over 37,000 intoxication cases.

Combustion Safeguards on Industrial Gas-Fired Equipment. D. P. Congdon. *Ind. Heating 27,* 2085 (1960) Oct. (7 pp.)

Although losses in heating equipment will continue to occur, such losses can be greatly reduced by requiring that the installation be properly designed and maintained—that hazards be reduced or eliminated—that plants be properly constructed and properly protected. Some of the standards for guidance in equipment protection and some of the equipment for adequate combustion safeguard are discussed.

Space Heating

Sell Gas Central Heating — Impartial Figures Show Its Cheapness. W. F. Coxon. *Gas J. 304,* 114 (1960) Oct. 19 (3 pp.)

Author claims that the mass central heating market (in Great Britain)—or more accurately, the semicentral heating market—is likely to be met by installations providing 20,000 Btu/hr for smaller houses, to 45,000 Btu/hr among the larger, with the 30,000 Btu installation being a popular best seller. It is in these markets that he compares the merits of competitive fuels.

2. ENERGY SUPPLY AND ECONOMICS

Natural Gas

Home Markets Offer Growing Outlet for Texas-Louisiana Gas Reserves. R. L. Conkling. *World Oil 151,* 145 (1960) Oct. (5 pp.)

Current gas reserve discovery levels in Texas and Louisiana, which averaged a little less than 15.3 trillion CF in the 1955-59 period, will fall far short of meeting growing demands on the industry in the next five years. By 1964, the annual level of new discoveries, extensions and revisions in these two states will have to increase by about 38% to meet the full requirements of local and interstate natural gas markets. In fact, if recent finding levels are not substantially expanded, the local market alone will absorb half of the new reserves. This situation well known to the industry itself but misunderstood beyond industry circles is proved by the annual consumption forecasts presented last month (see *Gas Abstracts 16,* 224).

Gas Reserves

Our Future Gas Supply. R. D. Stanwood. *Gas Age 126,* 48 (1960) Oct. 13 (2 pp.)

Life index of supply to market is leveling off at about 21 years. To insure the continuation of this index, the gas producer must be assured of a reasonable set of regulatory rules and a price which gives him incentive to find and produce more gas. On the other hand, gas cannot price itself too high in the supply area. If prices

to the pipeline should increase much more than the present $0.23-0.25, it will be extremely difficult, and perhaps impossible in some areas, to sell more natural gas.

Production and Utilization of Gas in Venezuela. R. A. Caro. *Interstate Oil Compact Commission Comm. Bull. 2,* 46 (1960) June (18 pp.)

Since the beginning of the oil industry in Venezuela, all exploration effort has been directed to locating oil deposits, without taking into account the gas discovered during these operations. Consequently, most of the gas produced is associated gas. For many years, production of gas was an impediment; most of it was flared. Only the production of oil was fiscalized. It was in 1940 that computation of gas figures was started.

Regulators Turn to Gas Reserves. *Petrol. Week 11,* 23 (1960) Oct. 21 (2 pp.)

Federal Power Commission is studying alternate methods of computing reserves. Most significant indication that a new course may be in the making is a current proceeding involving Transcontinental Gas Pipeline Corp. Traditionally, the industry has relied on volumetric methods for computing reserves. Now, the FPC staff apparently favors the pressure-decline or flow-test method for calculating gas reserves. Change, if it is made, would have a broad impact.

Competitive Fuels

Coal-Slurry Pipeline Nearer. *Oil Gas J. 58,* 103 (1960) Nov. 7.

Texas Eastern Transmission Corp. recently elected a new vice president to supervise a $125-million-plus pipeline project for transporting coal in a slurry. TET is working jointly with Consolidation Coal Co., Pittsburgh, to put together the pipeline project to move West Virginia coal some 350 miles to electric utility companies in Pennsylvania, New Jersey and New York. The cost, including the coal mine, would run between $125-$150 million.

Heat with Oil in Winter Cool with Oil in Summer. *Fueloil and Oil Heat 19,* 47 (1960) Nov. (5 pp.)

Year-round air conditioner powered by fueloil in summer and in winter was displayed for the first time last April. Its manufacturer, Arkla Air Conditioning Corp., announced that it is available in two sizes. Model 500-FO is fired .57 gph for refrigeration to provide summer cooling; its delivered capacity is 42,000 Btu/hr for cooling, or 3½ tons. Model 750-FO is fired .86 gph to provide summer cooling; capacity is 60,000 Btu/hr for cooling, or 5 tons. For heating in winter, both models are fired at .86 gph, which provides 96,000 Btu/hr bonnet capacity.

Electricity

Unique Swedish Steam Station in Operation. H. Lundbergh. *Combustion 32,* 40 (1960) Oct. (2 pp.)

Eventual 700,000 kw steam power plant to occupy roughly one-half acre well underground at a cost of $40 million will double the State Power Board's thermal power capacity in less than a year's time.

Energy Sources

Europe's Energetic Forecasting. P. Chantler. *J. Inst. Petrol. 46,* 299 (1960) Oct. (15 pp.)

Article is primarily a comparison of the Hartley (1955) and the Robinson energy forecasts. Author believes that intelligent long-term energetic forecasting is a useful exercise—providing that its limitations are clearly expressed and understood, and that mistaken interpretations from it are corrected as opportunity serves. It is hoped that such long-term forecasts will not be made the basis for short-term decisions. Author also hopes that a year other than 1975 will be selected as the target date in forecasting.

Fuel Cells

Fuels Cells: A Big Push Gets Bigger. J. J. O'Connor. *Power 104,* 59 (1960) Nov. (5 pp.)

Fuel cell research and development is outspending last year's $35 million in corporate funds, while other segments of research are being held to a middle-of-the-road policy. One big goal: to develop a low-temperature low-pressure hydrocarbon cell. There is little agreement when present research in low-pressure, low-temperature cells will make impact; experts think it will precede wide commercial use of thermoelectrics or thermionic converters. Military applications are being made now. First uses in industry will be portable, low-power sources. If and when a cell for large stationary energy supplies is developed, it will probably be a high-pressure, high-temperature device using hydrocarbon fuel.

Fuel Cell Thermodynamics. A. J. deBethune. *J. Electrochemical Soc. 107,* 937 (1960) Nov. (3 pp.)

Simple fuel cell, operated reversibly, puts out, either electrochemically or in osmotic-mechanical form, an amount of useful work equal to the chemical potential released isothermally by the fuel plus oxygen upon their combination. This may be larger than the corresponding Carnot output of the same amount of fuel used to fire a reversible heat engine. A coupled (regenerative) fuel cell regenerates the cell reagents by decomposing the reaction products at a high temperature (obtainable from a nuclear reactor). It thus acts as a heat engine in converting heat from the nuclear reactor into useful work. Its reversible work output is exactly equal to that predicted from the heat inputs by Carnot's theorem in integral or differential form, for any fuel cell reaction, and for zero and finite values of ΔC_p for the cell reaction. The useful work output of an idealized practical irreversible fuel cell cycle is also given.

Nuclear Energy

Development of a Simulated High-Temperature Nuclear Loop. J. P. McGee, N. H. Coates and G. E. Fasching. *U.S. Bur. Mines Info. Circu. 7981,* 17 pp. (Washington, D.C.: U.S. Govt. Print. Off., 1960, $.20.)

Simulated nuclear loop has been constructed to test

components used in a program conducted to develop means of utilizing nuclear energy to supply process heat. This loop has been operated for more than 1800 hours at 100 psig. Of this period, 23 hours were at 2500°F and higher; 540 at 2000° to 2500°F; 840 at 1500° to 2000°F; 200 at 1000° to 1500°F; and 250 below 1000°F. Leakage at flanges and welds was not a serious problem. A helium-recycle system with gas temperatures of 2300°F and a static pressure of 250 psig appears feasible. Difficulties were encountered with the recycle compressor due to thermal distortion of the impeller and shaft. The use of sealed bearings limits compressor operation to the life of the bearings.

Oil Gas

On the Economics of Production of City Gas by Oil Gasification. W. A. Brodnicke. *Erdol und Kohle 13,* 569 (1960) Aug. (4 pp. German text.)

Study presents one of the most useful forms of calculation of the economics of oil gasification plants. The most significant factors involved in gas price—investment cost, labor and management cost, materials and operating cost—are determined, and their influence is evaluated on plants operating at 50, 75 and 100% capacity.

Petroleum Prices

The Issue: World Oil Price Dictation. W. M. Jablonski. *Petrol. Week 11,* 28 (1960) Oct. 21 (2 pp.); **Report from Beirut: Rift Widens Between Nations, Firms.** P. Swain. *Oil Gas J. 88,* 51 (1960) Oct. 31 (2 pp.); **World Oil Conservation—The Arab View.** A. H. Al-Tariki. *World Petrol. 31,* 48 (1960) Nov. (2 pp.)

Second Arab Petroleum Congress left no doubt that the issue at stake is something approaching worldwide price dictation and complete managerial control of the oil industry. It is clearly the intent of the two men who are the guiding spirits of this Congress: Saudi Arabia's Director of Petroleum Affairs, Abdullah Tariki, and Venezuela's Minister of Mines & Hydrocarbons, Juan Perez Alfonzo. Tariki declared that Middle East posted prices should be equalized with Venezuelan oil at London, not New York, and equalized, moreover, with the higher-priced U.S. Gulf postings, not Venezuelan postings. His formula: the Middle East posted price should be equal to the U.S. Gulf price plus actual transportation from the Gulf to London, minus actual transportation from the Middle East.

Foreign Prices Phony? *Oil Gas J. 58,* 51 (1960) Oct. 31 (2 pp.)

In his paper, Abdullah Tariki of Saudi Arabia included a claim that big companies pocketed $5.5 billion in hidden profits. It is concluded that the needling set the stage for the January 15 Caracas (Venezuela) meeting of the Organization of Petroleum Exporting Countries. Representatives of big companies who attended the Second Arab Petroleum Congress tried to refute Tariki's accusation. It is not known whether the Arab audience was swayed by the rebuttals; Tariki was not.

Say the Russians: We'll Take More of the Market, Please. *Oil Gas J. 58,* 54 (1960) Oct. 31 (2 pp.)

Russians served notice, through E. P. Gourov, chairman of Sojuznefteexport, to the delegates at the Second Arab Petroleum Market that they are in the oil market to stay. Furthermore, the intent to grab an even bigger share of a distressed market for themselves was implied. Gourov asserted that the Russians are only renewing the legal place among exporting countries which once belonged to them. He denied assertions that the Soviet is dumping oil in today's market or that it is undercutting the price structure.

Solar Energy

Analysis of Solar-Furnace Performance in Mechanical Testing at Extremely High Temperatures. G. S. Leon and M. E. Shank. *J. Eng. for Power* (Series A) *82,* 325 (1960) Oct. (8 pp.)

Present investigation is concerned with the analysis of fluxes and temperatures that can be attained in tensile specimens undergoing mechanical tests. Account is taken of heat loss by conduction and reradiation. It is shown that 1) attainable temperatures are considerably lower than those reached in flat-plate receivers; 2) with normal low-aperture furnaces (i.e., 60 deg), a large furnace is necessary to reach high temperatures with adequately large specimens; and 3) furnaces best adapted to mechanical testing would have larger apertures (120 deg) than are now commonly conceived.

Solar Turbo Power Plant Design. D. B. Mackay and E. L. Leventhal. *J. Eng. for Power* (Series A) *82,* 315 (1960) Oct. (10 pp.)

Design of a lunar-based power plant, powered entirely by solar radiation, is discussed. Factors affecting power plant design and a discussion of a performance basis for a working fluid are also presented. Graphs and equations which illustrate theory, optimize results, and demonstrate intercomponent relationships, are included. Also, a design for a novel, compact power plant is introduced.

Thermoelectricity

Rapid and Precise Control Procedures Are Essentials for Quality Thermoelectric Materials. G. V. Downing, Jr. *ASHRAE J. 2,* 44 (1960) Nov. (3 pp.)

How to obtain satisfactory measurements in minimum time on the samples which are submitted to a control laboratory is the task considered. Author reports on a procedure which reduces the time required to obtain a resistivity profile to about five minutes. It also reduces uncertainties in the measuring of thermal conductivity to permit a routine test with truly comparable results. Also described are the procedures for measuring Seebeck voltage and thermal conductivity accurately on a rapid routine basis.

Thermoelectric Assembly. L. A. Jarvis, and J. B. Heinicke (assigned to Whirlpool Corp.) U. S. 2,949,497 (1960) Aug. 16.

Thermoelectric device is claimed, in which an insulating dielectric sleeve containing the thermoelectric element is clamped between the two terminal members.

These terminals are locked by annular shoulders into a block of insulating material; one terminal contains an aperture which is large enough to permit passage of the thermoelement and is closed by a threaded cap.

Thermoelectric Refrigeration Now Competitive for Applications to 300 Btu/hr. P. F. Taylor and L. A. Staebler. *ASHRAE J. 2,* 55 (1960) Nov. (2 pp.)

Predictions as to the competitive position of thermoelectric refrigeration set forth in a previous article (see *Gas Abstracts 16,* 150) were too conservative as to time and capacities. Then, thermoelectric systems seemed two years off for the 200 Btu/hr ratings. Progress by manufacturers of TE materials in cost reduction, coupled with advances in design and technology of TE systems, put commercial thermoelectric refrigeration right in the present for some applications to 300 Btu/hr.

3. NATURAL GAS AND PETROLEUM PRODUCTION

Drilling

Air Motor Drill Promises Drilling Improvements. H. J. Magner. *Petrol. Eng. (Drilling and Producing) 32,* B-46 (1960) Oct. (3 pp.)

Air motor drill is basically simple in design. It consists of two vane-type motors in parallel, driving a common shaft. This shaft turns at approximately 4000 rpm but is geared down to 400 rpm as its normal free speed. Compressed air flows down the drill pipe and collars through the air motors, driving the shaft to rotate the bottom sub and bit. Air passing through the motor is exhausted through the ports of the bit, but any surplus air can be deflected through a bypass around the air motors to the bit.

The Art of Cable Tool Fishing. A. O. Ames. *Petrol. Eng. (Drilling and Producing) 32,* B-92 (1960) Oct. (3 pp.)

Extended fishing job can be the most expensive part of a drilling operation, whether rotary or cable tool. But proper use of tools and techniques has reduced most cable tool fishing to routine. Unique nature of cable drilling methods results in fishing problems which have required the development of tools and techniques peculiar to this method. Some of these tools—such as fishing jars and spears—have been adapted successfully for use in rotary fishing operations.

Care and Maintenance of Tool Joints. S. G. Marshall and C. R. Frederick. *World Oil 151,* 117 (1960) Oct. (11 pp.)

Considering the number of rigs operating and the footage they drill each year, drill string problems today are not excessive. However, when they do occur, they generally are expensive, resulting in fishing jobs or expenditure of money for repairs. Extensive work is being carried on to determine causes of drill string and connection problems. Findings can help operators reduce drill string costs. Article is designed to benefit all personnel interested in obtaining the best possible performance from drilling strings. A majority of the more common problems encountered in the field are included.

Check List Minimizes Accidents While Drilling with Gaseous Fluids. G. Jackson. *World Oil 151,* 128 (1960) Oct. (6 pp.)

Growth and safety of air drilling: during 1960, it is estimated that air or natural gas may be used in at least 10% of all wells drilled in the U.S. On this basis it is not unreasonable to assume that with the growing number of tools, methods and techniques, a gaseous drilling fluid will be circulated in more than 30% of new holes begun in 1963. Closed circuit drilling, redesigned and improved compressor packages, and advanced air drilling methods are also destined to boost the use of air and natural gas in workover and completions.

Design and Operation of Jet-Bit Programs for Maximum Hydraulic Horsepower, Impact Force or Jet Velocity. H. A. Kendall and W. C. Goins, Jr. *J. Petrol. Tech. 12,* (Tech. Paper 8129) 238 (1960) Oct. (13 pp.)

Authors explain how pump horsepower can be most efficiently used with working charts to enable operators to cope with specific needs, and present a typical field example as a basis for illustration. Solution for a problem using mathematical theory is presented.

Drillstem Tester Frees Stuck Pipe. B. J. Sartain. *Petrol. Eng. (Drilling and Producing) 32,* B-87 (1960) Oct. (2 pp.)

Pipe stuck by differential pressure can be released with drillstem testing tool . . . and this might lead to a new hydraulic fishing tool. Benefit to be gained from this tool would result from the sudden decrease of pressure in the bore hole when the hydraulic testing tool was opened after being run into the hole. This pressure decrease would cause the borehole pressure to drop below that of the formation against which the pipe was stuck, reversing the pressure differential and freeing the pipe.

A Guide to Job-Rating a Well for Minimum Rig Horsepower in Jet Bit Drilling. J. W. Peret and J. E. Kastrop. *Petrol. Eng. (Drilling and Producing) 32,* B-19 (1960) Oct. (16 pp.)

Objective of study was to establish minimum horsepower requirements for pumping and for hoisting. Authors claim this has been done in accordance with acceptable jet bit drilling practices for the most popular hole and drill string sizes. Data and results are presented in tabular form.

How to Cut Rig Moving Costs. M. T. Parker. *Petrol. Eng. (Drilling and Producing) 32,* B-68 (1960) Oct. (5 pp.)

Rig moving time in some areas may amount to as much as 20% of the total drilling cost; thus the design of equipment for efficient moving is essential. Design engineers have unitized equipment, designed rotary rigs to assemble in the same way on each move, and standardized equipment design to facilitate fast installation on any rotary rig. Emphasis on good design for

moving rotary rigs will be stressed much more in the future than in the past.

How to Forecast Accurate Drilling Costs. O. E. Mecham and M. S. Legge. *World Oil 151,* 112 (1960) Oct. (5 pp.)

Profile method of forecasting drilling penetration rates and bit footages has been time-tested in many areas by contractors and operators and found to be accurate when properly applied. Method described may appear highly technical, tedious and time consuming. However, as facility is acquired, such analyses may be made in 6-12 hr, depending on the amount of control available, the depth of the test well, and presence or absence of abnormal problems anticipated.

New 8-in. Air Hammers Cut Drilling Costs in Big Holes. J. E. Eckel, S. D. Murray, B. M. van Meter and W. E. Liljestrand. *Oil Gas J. 58,* 125 (1960) Nov. 7 (4 pp.)

Field tests of a new 8-in. hammer drill prove that it can extend percussive air and gas drilling to hole sizes as large as 13¾ in. Previously, the 6-in. and smaller hammer drills which were available were suited for holes not larger than 9-in. diameter. The 8-in. tool operated without mechanical trouble and made hole 1⅔ to 2⅓ times faster than conventional rotary air drilling. Moreover, bit life was 30-60% longer.

Drilling Muds

Effect of Completion Fluids on Well Productivity in Permafrost, Umiat Field, Alaska. G. L. Gates and W. H. Caraway. *J Petrol. Tech 12,* 33 (1960) Oct. (8 pp.)

Results of 11-well program show that use of muds containing water, particularly fresh water, damaged the productivity of some wells. It is shown that the highest productivity was obtained by using oil- and oil-base muds, and that intermediate production was received by using chloride brines and cable tools.

Geology

Where Is the Basement? H. T. Brundage. *World Oil 151,* 170 (1960) Oct. (8 pp.)

Knowledge of depths required to evaluate the deepest economical prospective zones is crucial to any thorough exploration program. The depth to basement not only varies from one area to another, but the lithology of so-called "basement" rocks may vary greatly also. As the technology of deep drilling advances and deeper horizons are proved for profitable production, depths and horizons now constituting "economic basement" in some areas will be increased in favor of deeper ones. Depths of basement in various world basins are listed.

Reservoir Engineering

The Effect of Vertical Fractures on Well Productivity. W. J. McGuire and V. J. Sikora. *J. Petrol. Tech. 12,* (Tech. Note 2068) 72 (1960) Oct. (3 pp.)

Experimental conditions and assumptions used in the study on an electronic computer of the effects of vertical fractures on productivity of wells in expanding fluid drive reservoirs are presented.

Secondary Recovery

Method of Forming Underground Communication Between Boreholes. C. A. Bays (assigned to Food Machinery and Chemical Corp.) U. S. No. 2,952,449 (1960) Sept. 13.

Improved process for recovering soluble materials from an underground formation is claimed. This process consists of drilling two boreholes at a desired separation down to the formation, then establishing underground communication through the formation and between the boreholes by the usual hydraulic fracturing method, pumping a fluid which dissolves the desired constituent along the fracture lines. Improved results are obtained by maintaining high pressures on the first borehole while fracturing the second.

Miscible Displacement—Flow Behavior and Phase Relationships for a Partially Depleted Reservoir. J. F. Wilson. *J. Petrol. Tech. 12,* (Tech. Paper 8127) 223 (1960) Oct. (6 pp.)

Results are presented of phase equilibrium and long-core flow studies used to aid in evaluating the feasibility of gas-driven miscible-slug recovery process for a partially depleted reservoir.

Miscible Fluid Displacement—Prediction of Miscibility. A. A. Benham, W. E. Dowden and W. J. Kunzman. *J Petrol Tech 12,* (Tech. Paper 8128) 229 (1960) Oct. (9 pp.)

Article outlines calculation method and generalized correlation of the conditions for miscible displacement of oil by rich gas for use in making preliminary field studies.

4. GAS CONDITIONING AND LPG RECOVERY

Dehydration

Activated Alumina for Gas Drying. D. Janchen. *Chem. Eng. 67,* 115 (1960) Oct. 31 (6 pp.)

Author examines the question of why alumina oxide, when used as a drying agent in a technical gas drying process, showed unsatisfactory process life (see *Gas Abstracts 15,* 291). He believes that reduction in adsorptive capacity results from three causes: improper coating; reduction of the surface area of the aluminum oxide by sintering during thermal stress periods; and recrystallization of the aluminum oxide to inactive crystal forms. These are discussed.

Gas Hydrates: A Practical Control Method. Part 2. L. E. Connealy. *Oil Gas J. 58,* 130 (1960) Oct. 17 (5 pp.); **Controlling Gas Hydrates.** L. E. Connealy. *Gas 36,* 101 (1960) Nov. (8 pp.)

Injections of methanol are used by Texas Eastern Transmission Corp. to prevent the formation of gas hydrates.

Methods have been refined so that both the frequency of occurrence and the cost of correction have been reduced appreciably.

Gas Hydrates: A Practical Control Method. Part 3. Conclusion. L. E. Connealy. *Oil Gas J. 58,* 173 (1960) Nov. 7 (4 pp.)

Final article of series describes steps associated with the injection of methanol. Author points out that while Texas Eastern Transmission Corp. has worked out a plan to effectively control hydrates by methanol injection, that another method of hydrate prevention may prove more economical under a different set of circumstances. He recommends that other systems with gas-hydrate problems should consider the use of heat, glycol injection and methanol injection before arriving at a decision based on practical and economic considerations.

Hydrocarbon Hydrates in Pipeline Transport of Natural Gas, and Methods of Prevention. H. Seebaum. *Gas- u.-Wasserfach 101,* 981 (1960) Sept. 23 (5 pp. German text.)

Since demand for natural gas is continually increasing, the problem of hydrocarbon hydrates has much significance. Article describes the formation conditions for gas hydrates, special hydrocarbon hydrates, and mixed hydrates. Much work is reported on the structure of hydrates. It is shown how drying the gas eliminates hydrate formation. Four drying methods are discussed: refrigeration condensation; scrubbing with hygroscopic inorganic salt solutions; scrubbing with liquid organic absorbents; and contacting with solid absorbents. Limitations of the processes are mentioned.

Hydrocarbon Recovery

Liquid-Recovery Plants Profit Pembina Producers. H. C. Bozeman. *Oil Gas J. 58,* 118 (1960) Nov. 7 (3 pp.)

Eight satellite field recovery units are the key to successful flare-gas conservation at Pembina field (Alberta, Canada). Costing over $20,000,000, the system annually saves about 26 billion CF of natural gas for marketing or reinjection, and produces about 60 million gallons of marketable gas liquids. Cooperative project covers 207,000 acres, connects 279 tank batteries owned by 76 different producers to central fractionation facilities, and has design capacity of 90,750 MCF/day.

Hydrocarbon Removal

Method of Processing Gas. C. D. Spangler, Jr. and L. L. Laurence (assigned to Black, Sivalls & Bryson, Inc.) U. S. 2,951,347 (1960) Sept. 6.

Method of processing a high-pressure natural gas to recover desirable liquefiable constituents is claimed comprising, initially, cooling the gas to condense the liquids. The condensed liquid is separated from the gas, further cooled and expanded into a liquid collecting zone to liquefy additional desirable constituents. A hydrate inhibitor is injected to the gas prior to expansion in amounts sufficient only to prevent critical hydrate formation. The separated liquids flow into the liquefied constituents in the collecting zone and are heated to melt the gas hydrates, and the desirable constituents are separated from the gas.

Hydrogen Sulfide Removal

Design and Operating Tips for Ethanolamine Gas Scrubbing Systems. G. D. Hall and L. D. Polderman. *Chem. Eng Progress 56,* 52 (1960) Oct. (7 pp.)

Two types of plants commonly utilize the ethanolamines as acid gas absorbents: the Girbitol process, which employs a relatively dilute solution of either mono- or diethanolamine, and the Fluor process, which generally uses a mixture of MEA and diethylene glycol with approximately 5% water. Most commonly encountered operating problems are foaming, caused by contaminants in the solution; presence of degradation products in the circulating solution; sludge accumulation; and corrosion which is likely to be most severe in MEA systems removing only CO_2 since mixtures of H_2S and CO_2, and H_2S alone are progressively easier to handle with the materials of construction used.

Patents for New Liquid Purification Process. *Gas World 152,* 563 (1960) Oct. 22; **Joint Patents Sought on New Liquid Purification Process. North Western Board Moves on H_2S Sulphur Process.** *Gas J. 304,* 172 (1960) Oct. 26.

Worldwide patents have been applied for in the joint names of the North Western Gas Board and Clayton Aniline Co. Ltd. in respect to a process for extracting hydrogen sulfide and recovering pure sulfur from coal gas, petroleum gases and other gases. Agreements have been entered into to grant licenses — if patents are granted—to exploit the process to six chemical engineering firms of world repute. The process is to be installed shortly at one of the Board's largest works, the Linacre station in Liverpool. Designated the "Stretford" process, the method consists of washing the gas to be purified with a mixture of the sodium salts, dissolved in water, of two special forms of anthraquinone disulfonic acids. These are the "2-6" and "2-7" forms whose molecular structure gives them a specially speedy reactivity. Before these acids were found to give the desired results, hundreds of dyestuff chemicals and dyestuffs themselves were tested for use.

Sulfur Recovery from Petroleum Gases. R. A. Graff. *Oil Gas J. 58,* 113 (1960) Oct. 17 (4 pp.)

Hydrogen sulfide gas, obtained as a byproduct from the desulfurization of gaseous or liquid hydrocarbons, provides an important raw material for the manufacture of elemental sulfur. There are several methods for converting hydrogen sulfide into elemental sulfur, but most of them have the disadvantage of being sensitive to impurities, such as carbon dioxide and hydrocarbons, that may be present in the acid gas stream. The one-third, two-thirds process, if operated properly, is almost impervious to any stream impurities. Equipment that has been designed and fabricated according to the general rules outlined in article plays a big part in making a plant of this type economically attractive as well as practical.

5. NATURAL GAS TRANSMISSION

Automation

An Automatic Control System for a Gas Pipeline Compressor Station. K. S. Hagius and L. R. Henry. *Pipe Line News 32,* 56 (1960) Oct. (7 pp.)

Colorado Interstate Gas Co. has recently installed an automatic control system. Article summarizes the studies leading to the decision to use automation concepts and outlines the particular plan of control which was employed. A description of some of the features installed at the Springfield compressor station also is included.

New Developments in Pipeline Compressor Automation. *Pipe Line News 32,* 62 (1960) Oct. (3 pp.)

Automatic turbocharger bypass control, hydromechanical drive system for turbocharger acceleration during startup and a constant control torque system are discussed.

Progress in Automation. Its Problems and Solutions. *Pipe Line News 32,* 27 (1960) Oct. (21 pp.)

Management of natural gas and of crude oil and products lines respond to 17 questions asked by the magazine in an effort to evaluate automation. Most feel more research and development is needed; one company in particular feels that cost of conversion and modernization (for computer pipeline control) may be prohibitive for companies with systems of old-type design.

Compressors

Calculations for Rotary Compressors. S. E. Zakharenko. *Trudi Leningrad Politekhn. In-ta,* 90 (1954) No. 2 (15 pp. Russian text); *Ref. Zh. Mekh.,* (1959) No. 6 (Rev. 6204). (From *Appl. Mech. Rev. 13,* 753 (1960) Oct.)

Description is given of the calculations for rotary compressors which compress the gas with a change in the volumetric capacity of the working chamber. An analysis is furnished of the influence exerted by various factors on the production, the delivery coefficient, the power and the coefficients characterizing the work of the machine. The method proposed enables all the characteristics to be determined prior to the assembly and testing of the compressor: production capacity, power, coefficients of delivery and efficiency and the functions for the degree of compression and the number of revolutions.

B. S. Dorogov
Courtesy, Referativnyi Zhurnal, USSR

Case History Report: Two-Cycle Gas Engine Driven Centrifugal Compressor in Natural Gas Transmission. C. Reynolds and J. Murphy. *Gas Age 126,* 45 (1960) Oct. 13 (3 pp.); **Two-Cycle Engine Proves Itself as Variable Speed Prime Mover.** *Pipeline Eng. 32,* D-20 (1960) Oct. (4 pp.)

Initial 1500 hours of operation indicate that the Columbia Gulf Transmission Co.'s installation meets the design requirements as a variable speed prime mover and that it will accomplish the economies aimed for in service cost on future compressor stations. Evaluation is not, however, complete.

Computers

Computers: How Effective for Pipeline Control? R. G. MacInerney. *Pipeline Eng. 32,* D-38 (1960) Oct. (5 pp.)

Ideal control system must have the ability to monitor the operation of each compressor unit and valve on the system, decide what its optimum settings should be, not only with regard to its own performance characteristics but in relation to those of every other unit in the same station and at all other stations on the line, and finally to modify the set points of the actuators to implement required flow conditions.

Control Computing. Part 2. Computer Types Applied to Pipeline Problems. G. Post. *Pipeline Eng. 32,* D-29 (1960) Oct. (6 pp.)

Author applies three computer types to three pipeline problems. An analog computer employed in a facet of natural gas compressor station control is applied to a problem involving emergency controls and a small optimization requirement. A general purpose digital central computer is considered as a master central dispatcher unit for a large multiline natural gas system including tie-ins with a communications system and data loggers.

Engines

Today's Gas Engines. H. C. Bozeman. *Oil Gas J. 58,* 129 (1960) Nov. 7 (3 pp.)

Development of gas engines over the past 25 years has increased thermal efficiency to 37% and reduced floor area to 15% of the original. Gas turbines now show promise of meeting the current emphasis on minimum-first-cost prime movers. Design of packaged units should represent the best combination of all components. Applications of engine-driven balanced-opposed gas compressors is economic where fuels other than natural gas are available.

Pipeline Construction

Heavy Cement Coating Solves Soil Condition Problem. L. J. Moremen and J. R. Williams. *Pipeline Eng. 32,* D-35 (1960) Nov. (3 pp.)

San Diego Gas and Electric Co. is constructing a 51-mile, 30-in. gas transmission line that, because of unusual soil conditions, posed a problem in design. The problem is generated by the 11 rivers and marshes that the line crosses during its first 25 miles. Specifications for the job included a reinforced concrete jacket. The ½-in. wall pipe with 6-in. coating weighs 844 lb/linear ft, and the ¾-in. wall pipe with 4-in. coating 674 lb/linear ft. A 40-ft random length of pipe will weigh approximately 16 tons and 12½ tons, respectively.

Valve Sentries Guard River Crossings. *Gas 36,* 73 (1960) Nov. (3 pp.)

Brief description of excess flow valve installation used by the Mississippi Valley Gas Co. on its pipeline river

crossing near Columbus in east central Mississippi. Valve is designed to allow two installation variations. First, in place of an orifice, any other restriction in the line can be used to provide a differential pressure in the diaphragm control housing. Second, the valve may be closed without an excess flow condition by manually or automatically opening a bleed line and releasing pressure above the diaphragm—provided the line pressure does not exceed 300 psi.

Pipeline Systems

How the New Transwestern Line Was Designed and Built. N. F. Blundell. *Oil Gas J. 58,* 100 (1960) Oct. 17 (8 pp.)

Transwestern pipeline system, 2000-miles-plus, began initial deliveries of gas at the Arizona-California state line on Aug. 9, 1960. Daily design capacity of the system is 300 MMCF, with reserve built into the system to give 350 MMCF/day for peak demands. Ultimate design capacity of the single-line system is 640 MMCF/day. Of the total 161,000 hp to be installed on the line, only 35,000 hp has been installed. The line contains a number of unusual operating and communications features.

Telemetering

Dispatching System Features Automatic Data Logging. R. Hurst. *Am. Gas J. 187,* 29 (1960) Oct. (3 pp.)

Added recently to Mississippi Valley Gas Co.'s telemetering system is an unattended automatic digital logger that converts remote readings and types out data ready for use by dispatchers. Logger takes a full set of pressure, flow and temperature readings from 23 different stations as often as three times an hour, and is making the company's dispatching operations more efficient and economical.

6. GAS AND LPG STORAGE

Methane Liquefaction

Apparatus for the Maintenance of Liquefied Petroleum Products and Method of Manufacture Thereof. F. A. Clauson (assigned to Texaco, Inc.) U.S. 2,952,987 (1960) Sept. 20.

Apparatus for storage of low-temperature liquefied petroleum gases is claimed which comprises an inner and outer receptacle. The latter contains a petroleum product with low heat transmission surrounding the inner receptacle. The petroleum, in the presence of the low-temperature wall, deposits a layer of waxy or asphaltic solids which further reduce the heat transfer, and this deposit is supported by a cellular construction of the outer wall of the inner tank.

How Feasible Is Underground Storage of Liquefied Methane? D. A. Flanagan and P. B. Crawford. *Am. Gas J. 187,* 34 (1960) Oct. (4 pp.)

Article has been reviewed earlier; for abstract see *Gas Abstracts 16,* 155.

Means for Tranportation of Low Temperature Liquids. J. H. Farrell, J. P. Hunsaker, A. Pastuhov and G. Y. Robinson, Jr. (assigned to Conch International Methane, Ltd.) U.S. 2,954,003 (1960) Sept. 27.

In the transportation of liquefied low-temperature gases on a ship or conveyance, a method of stabilizing the insulated container is claimed. This consists of stabilizing the centers of the bottoms of the individual tanks by means of wooden keys on the tanks which can slide in lengthwise keyway slots in the balsa-insulated ship floor, and also slide in transverse short slots. These prevent, respectively, side motion of the tank during rolling of the ship but permit lengthwise tank contraction, and prevent lengthwise motion of the tank during pitching but permit transverse tank contraction or expansion. The top of each tank is also stabilized, but by two sets of cables extending lengthwise and crosswise between the tank top and the ship frame. The cables rise at a low angle to the top from rows of lugs welded on either side of the top centerline and maintain an equal tension during contraction and lowering of the top.

Processing Liquefied Natural Gas. W. H. Marshall, Jr. (assigned to Conch International Methane Ltd.) U.S. 2,952,984 (1960) Sept. 20.

Process is claimed for separating the components of liquefied natural gas which comprises feeding the raw liquefied gas under pressure to the medial portion of a fractionating zone. The contents of the lower portion of the fractionating zone are heated to drive out methane as vapor. The vapor overhead is heat-exchanged with the raw feed to approach the bubble point. The condensates are returned to the upper portion of the fractionator to sweep down heavier fractions. The gas overhead from condensates is expanded through a work-producing zone (turbine) to recover power. The expanded gas (methane), the heavier condensed fractions, or both, may be reformed and blended for city gas, or separately used in making petrochemicals.

What's Involved in European Importation of Liquid Methane? *Oil Gas J. 58,* 138 (1960) Oct. 31 (2 pp.)

Importation of liquid methane in European countries involves a great number of legal problems, but most are routine and none should be a real obstacle to shipments on a commercial scale. This is the opinion of Hedley Parker, legal advisor to the British Gas Council. Problems outlined by Parker in a paper delivered before the International Bar Association in Salzburg covered the structure of the gas industry in the importing country, obtaining supply and arranging for export, safety measures, customs duties, economics, and political considerations.

Storage

Horsepower Requirements Involved in the Production and Delivery of Natural Gas. R. S. Jefferies. *Gas Age 126,* 33 (1960) Oct. 13 (6 pp.)

Industry's growth is traced with respect to its bearing on requirements for gas storage to meet market demands. General power requirements and compressor functions are outlined, as well as compressor design

problems involved in determining required storage pool operations. Economic value of storage vs pipeline capacity it compared.

Non-Conventional Storage of Natural Gas. B. E. Eakin. *Am. Gas J. 187,* 20 (1960) Nov. (5 pp.)

Article has been reviewed earlier; for abstract see *Gas Abstracts 16,* 129.

Underground Storage

Underground Ammonia Storage Has Disadvantages. H. S. Pylant. *Oil Gas J. 58,* 127 (1960) Oct. 24

Fifty-foot salt layer between two layers of anhydrite was found adjacent to the Cactus plant (Phillips Chemical Co., West Texas). The cavity was washed out, using the same procedure as in forming LPG storage, to a diameter of 50-60 ft. This provided an additional 35,000-40,000 bbl of ammonia storage 2000 ft below the ground. When the first withdrawal was made in March 1954, it was found that the cavity had not been completely dry and the effluent was a salty aqua solution containing about 60% ammonia. The contaminated ammonia must be purified before sale since the limit of salt content for agricultural use is about 1000 ppm.

7. MANUFACTURED GAS AND CHEMICAL PROCESSING

Adsorption

Underground Gasification

Sweetening Liquid Hydrocarbons with Molecular Sieves. E. L. Clark, H. B. Rhodes, R. A. Raidt and J. L. Lawrie. *Chem. Eng. Progress 56,* 132 (1960) Sept. (4 pp.)

Small openings or passageways in Type 13X molecular sieves are 8-9 A in diameter. Hydrogen sulfide, mercaptans, propane, and other hydrocarbons normally present in natural gas liquids have molecular dimensions sufficiently small so that they will all enter the molecular sieve crystals and be absorbed. Separation of sulfur compounds from hydrocarbons thus depends on selective adsorption, rather than conventional molecular sieving action, where one component is too large to enter the adsorbent. The polar sulfur compounds are much more strongly adsorbed than the hydrocarbons.

Aromatics

Hydrorefining of Benzoles and Naphthas. D. Bradley. *Gas J. 303,* 341 (1960) Sept. 7 (6 pp.)

Crude benzole is a mixture of benzene, toluene and xylene containing varying amounts of impurities, the quantity of which depends on the source of the material. There are two main classes of impurity: on the one hand the sulfur compounds and on the other the saturated and unsaturated hydrocarbons. Regardless of the eventual use of the benzole, it is necessary in most cases to remove sulfur from the benzole. Hydrorefining offers a convenient method of removing sulfur by converting it to the gaseous hydrogen sulphide, and at the same time converting the unsaturated hydrocarbons to the more stable saturated form. One then has the problem of separating the aromatics from the non-aromatic hydrocarbons, but the destruction of unsaturateds, bringing with it a serious effluent problem, is not encountered as it is with the acid washing process.

Butadiene

U. S.-European Technology Combine to Make Butadiene from Methane. J. C. Reidel. *Oil Gas J. 58,* 84 (1960) Oct. 31 (4 pp.)

Large ANIC petrochemical complex in Italy uses a unique combination of processes. Principal feedstock is methane. This plant makes butadiene via acetylene and acetaldehyde. Offgases from acetylene go to ammonia manufacture. End products include SBR rubber and fertilizers. A new butane dehydro unit implements butadiene production. Further diversification is underway.

Carbon Black

Carbon Black Growth Unchecked. *Chem. Eng. Progress 56,* 124 (1960) Sept. (2 pp.)

Oil furnace process, which now probably accounts for some 75-80% of world production, was introduced in 1943, and at once started its rapid climb to its present commanding position. Three factors are said to have influenced the fast shift-over to the new oil-furnace method. First, large-scale construction of natural gas pipelines, which allowed its use in cities far from its point of origin, made gas too expensive as a raw material. Second, use of liquid hydrocarbons, easily transported to any distance, freed the industry from the geographical limitations imposed by naturally-occurring sources of natural gas. Third, and perhaps most decisive, the oil-based blacks were found, in many cases, to have superior reinforcing properties over the channel product.

Catalysts

An Investigation of the Poisoning of a Platinum Catalyst with Thiophene Under Reforming Conditions. Part 2. The Use of Thiophene Containing the Radioactive Isotope S^{35}. Kh. M. Minachev *et al. Izv. Akad. Nauk SSSR, Od. Khim. Nauk 5,* 902 (1960) No. 5 (5 pp. Russian text.)

Poisoning was studied as a function of time and thiophene concentration for cyclohexane dehydrogentation at 450° and 20 atm.

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Catalysis on Metals of Group 8. Part 5—The Kinetics of the Hydrogenation of Cyclopropane and of Methylcyclopropane. G. C. Bond and J. Newham. *Trans. Faraday Soc. 56,* 1501 (1960) Oct. (14 pp.)

Kinetics of the hydrogenation of cyclopropane have been studied over pumice-supported rhodium, palladium, iridium, and platinum catalysts between 0° and 200°C. Orders of reaction, which depend on the method of

catalyst preparation, indicate the rate-controlling step involves adsorbed cyclopropane and adsorbed hydrogen atoms. Cyclopropane is probably chemisorbed as a π-complex. Activation energies and approximate adsorption coefficients are also reported. A kinetic study of the hydrogenation of methylcyclopropane over platinum-pumice shows that it is more strongly adsorbed than cyclopropane. Analysis reveals that the product is chiefly isobutane at room temperature, the proportion of *n*-butane rising to about 30% at 250°C. These results are interpreted in terms of the electron-releasing influence of the methyl group.

The Chemisorption of Hydrogen of Nickel. E. Rideal and F. Sweett. (Reprint from *Proc. Royal Soc., A., 257,* 291 (1960, 11 pp.)

Pressure of hydrogen in equilibrium with hydrogen adsorbed on nickel films produced by evaporation was measured by means of an ionization gauge. Observations were made at temperatures up to 200°C and included a previously unexplored range of surface coverages, θ down to about $\theta = 0.005$. From the results, the molar and differential entropies of the adsorbed hydrogen at 25°C and the integral and isosteric heats of adsorption were calculated. The molar entrophy in the range $\theta = 0$ to 0.4 agreed satisfactorily with the view that the adsorbed hydrogen was localized on sites which were energentically homogeneous. However, the entropy and the heat of adsorption indicated that there were sites of higher adsorption potential which amounted to about 1.5% of the surface. As θ increased from 0.4 to 1.0, the observed molar entropy at 25°C indicated a progressive increase in the proportion of the adsorbed hydrogen which, at any moment, was migrating over the surface. Near complete coverage the adsorbed hydrogen exhibited the behavior of a two-dimensional gas.

Role of Nucleation Processes in the Reactions Between Carbon Monoxide and Nickel. J. Bromley and R. F. Strickland-Constable. *Trans. Faraday Soc. 56,* 1492 (1960) Oct. (9 pp.)

It can be shown under certain circumstances a gas reaction in which a solid product is produced must necessarily be catalyzed by that solid product, and that in the absence of any such product the reaction will not easily occur at all. When CO reacts with reduced nickel, either free carbon or a metastable nickel carbide is produced. In the present research it appeared that if the CO reacts at 250°C carbide alone is produced; whereas at 400°C the product consists only of free carbon. If, however, after reaction at 400°C, CO is again added at 250°C, only free carbon is now obtained. Thus, the production of free carbon in the latter case is catalyzed by the free carbon previously produced at 400°C. The production of free carbon at 250°C in fact only occurs if free carbon is already present.

Coal

The Reflectivity Spectra of Coal Vitrains in the Visible and the Ultra-violet. L. A. Gilbert. *Fuel 39,* 393 (1960) Sept. (8 pp.)

Detailed account is given of a photoelectric method for measuring the reflectivity of a polished surface in the visible- and ultra-violet. Results are reported for seven coal vitrains having carbon contents between 85 and 94%, and for graphite and diamond, over the wavelength range 6000 A to 2350 A. The spectra fall into distinct types according to vitrain rank, and do not appear to indicate the presence of strong absorption bands characteristic of individual condensed hydrocarbons. If aromatic compounds are present, their complexity and number may increase with rank. The graphite reflectance peak at 2600 A does not occur.

Coal Gasification

The Impact on Coal Preparation of Smokeless Fuel Production and Total Gasification of Coal. W. R. Chapman. *Coke and Gas 22,* 449 (1960) Oct. (7 pp.)

Great Britain is about to undergo great changes in the utilization of coal, says author, and the approaching period seems to be one which will call for increased supplies—not to be used as coal directly—but for conversion into gas and oil synthesized from gas. Great integrated works, treating 10 million tons/yr. of coal, can be visualized. From these will come power and gas for distribution, oil and chemicals and perhaps use of the gas distribution system to transport powdered fuel. The effects of these developments on coal preparation look, at the moment, to be contractive rather than expansive.

Coal Hydrogenation

Hydrogenating Coal in the Entrained State. P. S. Lewis and R. W. Hiteshue. *Ind. Eng. Chem. 52,* 919 (1960) Nov. (2 pp.)

Equipment described was developed to perform experiments in which hydrocarbon gases and some liquids were produced by reacting coal entrained in hydrogen. The feeder delivered 200 g/hr of coal, sieve size 100-200 mesh, which was entrained in hydrogen flows varied from 75-500 SCF/min and pressures to 6000 psi. The coal and hydrogen were reacted at 800°C and residence times up to 6 sec in a reactor of 0.125-in. bore and 40 ft in length. The equipment may be used in other high-pressure systems where the feeding of solids is required.

Hydrogenating Coal in a Pilot Plant with a Molybdenum Catalyst. H. H. Ginsberg, S. Friedman, P. S. Lewis, M. D. Schlesinger, A. J. Stewart and R. W. Hiteshue. *U. S. Bur. Mines Rep. Invest. 5673,* (1960) 35 pp.

Effectiveness of 0.10% molybdenum, as ammonium molybdate impregnated on coal, on the hydrogenation of a high-volatile bituminous C coal at 8000 psig and 460°-480°C has been studied in a pilot plant by the Federal Bureau of Mines. Under these conditions, the Bureau obtained 98 to 99% conversion of coal to liquids and gases at throughputs of 29-101 of m.a.f. coal/cu ft of reaction space/hour. Operation, pilot plant layout, and equipment are described. Mechanical design details are shown for high-pressure equipment.

Producing Heavy Fuel Oil by Hydrogenating Bituminous Coal. H. H. Ginsberg, P. S. Lewis, R. B. Anderson and R. W. Hiteshue. *U.S. Bur. Mines Rep. Invest. 5674,* (1960) 57 pp.

Pilot plant investigations of the process requirements necessary to produce heavy fuel oil by the liquid-phase hydrogenation of bituminous coal were carried out in three separate series of experiments. These were conducted to 1) study the effect of temperature and contact time on product distribution at 3500 psig and 420°-480°C in the presence of 0.1 weight-percent stannous sulfide plus 0.05 weight-percent iodoform based on gross coal; 2) to evaluate tin, nickel, iron and zinc as catalysts for the hydrogenation of Rock Springs coal to heavy fuel oil at 3500 psig and 460°C; and 3) to evaluate tin, molybdenum, nickel and iron as catalysts for the hydrogenation of Rock Springs coal to heavy fuel oil at 1500 psig and 460°C. Findings are discussed.

Fischer-Tropsch

The Fischer-Tropsch Synthesis Using Gas Recycle Cooling. D. Bienstock, R. M. Jimeson, J. H. Field and H. E. Benson. *U. S. Bur. of Mines Rep. of Invest. 5655,* (1960) 25 pp.

Fischer-Tropsch synthesis is practicable in a reactor where the exothermic heat of reaction is removed by circulating large quantities of recycle gas through a catalyst bed of high-voids content. At an hourly space velocity of 1100, the feed gas, a mixture of 1.5 parts hydrogen to 1 of carbon monoxide, was converted 90%, producing hydrocarbons predominantly in the gasoline range. At these conditions a recycle-to-fresh gas ratio of 40:1 was enough to give excellent temperature control with a pressure drop of 1.5 psi per foot of bed using a steel catalyst in the form of lathe turnings. Steel parallel plates, although offering lower resistance to gas flow, were less reactive and less durable.

Hydrogen

Cryogenic Impurity Adsorption from Hydrogen. M. J. Hiza. *Chem. Eng. Progress 56,* 68 (1960) Oct. (4 pp.)

Article presents, for design purposes, an empirical correlation for determining the adsorptive capacities of the impurities likely to be found in low-temperature hydrogen processing for any selected operating pressure up to 100 atmospheres.

Industry Joins Liquid-Hydrogen Scene. *Chem. Eng. 67,* 164 (1960) Oct. 21 (4 pp.)

Private industry made its first full-fledged entry into the tonnage-liquid-hydrogen business this spring, when Union Carbide Corp.'s Linde Division started up its new plant on the West Coast to produce the liquefied light gas for rocket fuel use. The new 12,000-lb day facility is at Torrance, Calif., which places it near much of the government's current work in rocket research.

Hydrogenation

Purifying Olefins by Catalytic Hydrogenation. H. C. Andersen, A. J. Haley and W. Egbert. *Ind. Eng. Chem. 52,* 900 (1960) Nov. (5 pp.)

Ethylene, propylene, and other gas streams contain acetylenes and dienes which must be removed to make these gases useable for various processes. The acetylenes and propadiene are reduced to 10 ppm or lower by hydrogenation over catalysts consisting of supported palladium, or palladium in combination with another metal. For purifying ethylene or C-2 streams containing up to 2% C_2H_2, catalysts are available which operate at a H_2 to C_2H_2 ratio of 3 and space velocity of 4500 standard cubic feet per hour per cubic foot, a ratio of 1.2 and space velocity of 450, and intermediate combinations. A similar range of conditions applies to methylacetylene and propadiene removal from propylene.

Ore Reduction

Reduction of Ore. P. S. Viles (assigned to Esso Research and Engineering Co.) U. S. 2,953,450 (1960) Sept. 20.

Method of reduction of iron ore to pure iron is claimed, in which finely divided ore (0-300 microns) is mixed (20:1) with a dehydrogenating catalyst such as cobalt molybdate on alumina (0-25,000 microns). The mixture is preheated by a lower gas burner in a fluidized bed and then flows downward into a reduction vessel held at 850°-1600°F, where methane and air provide the fluidizing action, as well as the reduction and heating effects. The reduced iron may be separated by layer density in a separate fluidized vessel, or by screening (catalyst on larger support-bodies) or by magnetic means. The carbon-coated catalyst is burned off and recycled.

Stability Relations of Iron Oxides: Phase Equilibria in the Systems Fe_3O_4—Fe_2O_3 at Oxygen Pressures Up to 45 Atmospheres. B. Phillips and A. Muan. *J. Phys. Chem. 64,* 1451 (1960) Oct. (3 pp.)

Phase equilibrium data for the system Fe_3O_4—Fe_2O_3 have been obtained at oxygen pressures up to 45 atmospheres in the temperature range 1194-1588°. The crystalline phases magnetite and hematite coexist in equilibrium with liquid and gas in a eutectic situation at 1566°. Magnetite contains oxygen in excess of the stoichiometric (Fe_3O_4) amount, up to a maximum of 40 weight percent Fe_2O_3.

Petrochemicals

Petrochemical Acrolein by the Partial Oxidation of Propylene. P. W. Sherwood. *World Petrol. 31,* 60 (1960) Nov. (4 pp.)

Two developments of the last two years promise to make acrolein an important intermediate in the petrochemical industry. Foremost is the commercialization of Shell's new process for the synthesis of glycerine in which acrolein serves as key intermediate. Still in the research stage are two promising processes developed by Hoechst and Degussa for the manufacture of polyacrolein with molecular weights ranging from 50,000 to 300,000.

The Production of Phthalic Anhydride from Naphthalene. A. C. Bureau. *Gas J. 304,* 78 (1960) Oct. 12 (4 pp.)

Phthalic anhydride is one product obtained from

naphthalene which can readily be handled at the tar and byproducts plant of any large carbonizing undertaking. It commands a ready market, especially in the synthesis of dyestuffs and in the plastics industry. Production of phthalic anhydride from naphthalene takes place in the hot gaseous phase, in the presence of a catalyst, by oxidation. The reaction is exothermic. Process was evolved by Carbochimital Co., Padua, Italy.

Petroleum Refining

Advances in Petroleum Chemistry and Refining. Vol. III. Edited by J. J. McKetta, Jr., New York: Interscience Publishers, Inc., 1960. 544 pp., $16.80.

This volume, part of a series (see *Gas Abstracts 14*, 230, and *15*, 196), while particularly concerned with petrochemicals, maintains the original five-part plan: presentation of grouped studies in economics, unit operations, refining processes, petrochemicals and mechanical equipment. In Part I, the authors, R. L. Bateman and A. H. Tenney, draw upon long experience to review the economics and marketing of petrochemicals. Part II, unit operations, includes thermal liquid diffusion and fired tube heaters. Refining processes, Part III, deals first with mechanism of hydrocarbon isomerization. Detailed discussion with representative examples are given for thermal, acid- and base-catalyzed reactions. Next, hydrogenation of petroleum and fractions is treated, including chemical considerations and principal reactions of hydrocarbon and of impurities, as well as catalysts, process design and applications. Finally, hydrofluoric acid alkylation of paraffins is discussed. Group IV, petrochemicals, opens with a treatment of hydrocarbon oxidation. Vapor and liquid phase processes, mechanisms, and influence of partially oxidized products are treated. Petrochemical acetylene manufacture is detailed, including theory, process and product separation and recovery. Finally, the chemistry of the sulfur compounds in petroleum is discussed. Here, H. D. Hartough treats the compounds found by API Research Project 48, and reviews their properties and reactions by mercaptans, sulfides, disulfides, thiophenes and thianaphthenes. In Part V, recent advances in cooling towers are discussed.

Phenol

Synthetic Phenol. L. A. Agnello and W. H. Williams. *Ind. Eng. Chem. 52*, 894 (1960) Nov. (7 pp.)

Industry's excited over highly touted new routes to phenol. It is watching the Pacific Northwest and Dow's new toluene oxidation unit under construction. Scientific design has just tossed out another teaser—phenol via direct oxidation of benzene. But Dow's old-timer, the chlorobenzene process, still out-produces any other single process by far. Expanded again this year, it remains the company's main artery to its huge phenol and phenol-derived chemical family. Key to its longevity: versatility.

Pyrolysis

Mechanisms of Coal Pyrolysis. III—Variation of the Magnetic Mass Susceptibility and Some Related Parameters with Carbonization Temperature. P. A. Cavell and N. Berkowitz. *Fuel 39*, 401 (1960) Sept. (12 pp.)

Variations of magnetic mass susceptibility, weight loss and crystallite parameters with carbonization temperature have been investigated for three coals over the range 100°-900°C. It is concluded that carbonization over this range involves three fairly distinct pyrolytic processes. Up to about 400°C, a thermal maturation, akin to *in situ* maturation and primarily causing loss of functional groups, is envisaged to occur: between 400° and 650° C, active pyrolysis, leading to skeletal molecular changes, is thought to take place; and above 650°C, the dominant process is considered to be loss of peripheral hydrogen and consequent growth of carbon lamellae.

Two Mechanisms of Carbon Formation in the Decomposition of *n*-Paraffins, Naphthenes and Aromatic Hydrocarbons with Six and Seven Carbon Atoms on Silica Gel. A. P. Rudenko *et al. Izv. Akad. Nauk SSR, Otd. Khim. Nauk, 6*, 981 (1960) No. 6 (8 pp. Russian text)

Existence of two mechanisms—one at 690°-745° and one at 785°-825°—were confirmed.

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Reformed Gas

Production of City Gas from Natural Gas at Steinkohlengas AG, Dorsten. R. Pasternak. *Brennstoff-Chemie 41*, 294 (1960) Oct. 19 (4 pp. German text)

Construction and operating methods used at the Steinkohlengas plant for thermal cracking of natural gas are described. Composition of the cracked gas (Texaco partial oxidation) and the shifted gas, in which CO is converted, as well as the CO_2-free, CH_4-enriched pipeline gas, are discussed.

Whitby—Britain's No. 1 Natural Gas Town. Full Technical Data on the New Project. *Gas J. 303*, 484 (1960) Sept. 28 (6 pp); **Whitby Has Natural Gas Supply.** *Gas World 152*, 458 (1960) Oct. 1 (3 pp.); **Description of Installation.** H. Johnston. *Ibid.*, 460 (1960) Oct. 1 (5 pp.)

At Whitby, the existing horizontal retort plant has been completely superseded by the output from two natural gas wells in the vicinity. After dewatering and pressure reduction at the wellhead, gas is brought by a 3-in. steel main directly to the Whitby gasworks. After pressure and flow control, it passes through oxide purifiers to remove any H_2S into a methane holder, from which gas is taken at low pressure directly to a P. G. Hercules plant for reforming the methane to hydrogen and carbon monoxide. This is followed by cold enrichment with methane to a group 5 gas of 500 Btu/CF, and a specific gravity of .54.

Underground Gasification

***In Situ* Exploitation of Lignite Using Steam.** H. Purre (assigned to Phillips Petrol. Co.) U. S. 2,952,450 (1960) Sept. 13.

Process for hydrocarbon recovery from underground lignite strata is claimed, in which steam at 400°F is

injected through a well bore to fracture and preheat a zone around the well. The builtup steam pressure is then suddenly released, causing flash vaporization of accumulated hydrocarbons and shattering of strata. The released hydrocarbons are then flowed out of the well and recovered. Similar pressure buildup and release may be practiced on an adjacent well, so that fracturing produces a gas passage between the two wells and permits wide stratum volume to be exploited.

8. GAS DISTRIBUTION

Distribution Systems

Atlantic City Hotel Main Utilizes New Installation Methods. *Gas Age 126,* 25 (1960) Oct. 13 (2 pp.)

Stab-type couplings were employed to install 1200 ft of 10-in. service main in a street only 11 ft wide—a street which could not be blocked during installation. South Jersey Gas Co. engineers managed to effect the operation efficiently and rapidly.

2-Way Radio Allows Hartford Gas Co. Street Department to Pinpoint Its Supervision. *Gas Age 126,* 27 (1960) Oct. 13 (2 pp.)

Availability of transistorized units gives the Connecticut utility high reliability with low battery drain characteristics, as well as lower contract maintenance rates. Customer service also benefits.

Mains

Pipe Cleaning Machine and Cable Feeding Mechanism Therefor. J. D. Arnold. U. S. 2,953, 799 (1960) Sept. 27.

Pipe-cleaning machine is claimed which is designed to feed and rotate a flexible cable. The cable is fed through a manhole into the main, and there it drives a rotating scraper or cutterhead which removes the obstructions. The improved feature is the motor-driven cable reel which delivers the cable axially through a gearbox and clutch. The latter also rotate, but by adjustment of a sliding-gear and shift system, the cable can be fed forward, reversed or kept in neutral (no-feed) position.

To Lay a Giant Main, You Plan on Gigantic Scale. *Am. Gas J. 187,* 24 (1960) Oct. (5 pp.)

Laying a 36-in. steel gas main 29 miles through the heart of Chicago is a large undertaking. An even bigger undertaking for a three-year, $23,000,000 project is the advanced planning, coordination, and supervision for the project. Installation of the northern portion of the main is under the supervision of Peoples Gas Light and Coke Co. Article details the planning of the project.

Meters

Dry Gas Meters. G. Brookes (assigned to Meters Ltd.) U. S. 2,952,248 (1960) Sept. 13.

Dry gas meter of two-diaphragm type is claimed, in which the meter case encloses the two outer diaphragm compartments and a divided inner compartment. Each side of the latter forms an inner diaphragm compartment in which the corresponding diaphragm moves. Each inner and outer set of compartments is connected alternately to the inlet and outlet of the meter by a slide valve which is moved by the usual flag arm, rod and crank. The separable upper and lower parts of the case support the compartments and moving parts by internal lugs and ledges.

Propane-Air

Mobile Propane-Air Plant . . . A Tool for Maintenance and Emergency. F. Zapffe. *Am. Gas J. 187,* 60 (1960) Oct. (6 pp.)

Mobile self-contained propane-air plant has been added to the equipment of Lone Star Gas Co. (Dallas, Texas) to cope with unique operation and maintenance problems of the company. Trailer-mounted plant has capacity of 2,000,000 CF/day, and provides a substitute gas when a town's tap line is out of service undergoing repair.

Valves

Portable Gear Operator for Buried Plug Valves. W. C. Peters. Gas *36,* 66 (1960) Nov. (3 pp.)

New portable tool enables one-man operation of buried plug valves too large for manual wrench application. Among the characteristics is its ability to provide some 2000 ft-lb of torque without being cumbersome or complicated. Tool is designed in three parts, all of which are light in weight: valve operating stem, an operating stem housing, and a gear box with a 60:1 reduction ratio.

9. GAS FUEL UTILIZATION AND APPLIANCES

Air Conditioning

A Simplified Procedure for Calculation of Residential Cooling Loads. W. S. Harris and E. J. Brown. *ASHRAE J. 2,* 43 (1960) Oct. (8 pp.)

Aware of the need for a single procedure to estimate residential cooling loads, three trade associations appointed a joint committee to study those methods now used by various organizations in order to develop a common procedure that would be acceptable to the entire industry. Information on heat gains and data on cooling loads compiled from five research houses at the University of Illinois provided the basis for the proposed cooling load calculating procedure described, which approximated the measured maximum loads in each of the houses.

Air Pollution

Control of Nitrogen Oxides in Boiler Flue Gases by Two-Stage Combustion. D. H. Barnhart and E. K. Diehl. *J. Air Pollution Control Assoc. 10,* 397 (1960) Oct. (10 pp.)

Since 1957, an investigation has been underway to

determine what could be done to reduce the nitric oxide concentration in flue gases from power plants in the Los Angeles area burning residual and oil and natural gas. The program has developed into three phases: 1) study of operating boilers to determine, among other things, the levels of nitric oxide which existed in the flue gases; 2) laboratory studies to isolate the important design and operating variables affecting the formation of nitric oxide during combustion; and 3) field tests to check the control method developed in the laboratory. Article reports on results of investigation which subsequently led to the application of a method for reducing nitric oxide emission from power plant stacks.

The Design and Performance of the Aerosol Spectrometer. A. Goetz, H. J. R. Stevenson and O. Preining. *J. Air Pollution Control Assoc. 10,* 378 (1960) Oct. (7 pp.)

All filtration and impingement processes expose the surface of the particle prior to and after its retention to the shearing action of the passing air stream. It can be assumed that this shear must disturb seriously the dynamic equilibrium of loosely sorbed or condensed components on the particle surface (probably most effective in irritation) whenever they are present. Problem's solution is based on the application of high centrifugal acceleration to a continuous laminar flow of the aerosol under conditions which cause the fallout of the particle to follow Stokes' law at a velocity relative to the air flow so small that the surface shear is negligible.

The Development of Motor Vehicle Exhaust Emission Standards in California. J. A. Maga and G. C. Hass. *J. Air Pollution Control Assoc. 10,* 393 (1960) Oct. (5 pp.)

Motor vehicle exhaust standards adopted by the California State Department of Public Health included hydrocarbons and carbon monoxide. The standards represent a first attempt to set vehicular emission standards as a basis for control legislation. Judgments and decisions were of necessity based on present knowledge of the smog problem. As new data become available, the data will be revised.

Eye Irritants Formed During Photo-Oxidation of Hydrocarbons in the Presence of Oxides of Nitrogen. E. A. Schuck and N. A. Renzetti. *J. Air Pollution Control Assoc. 10,* 389 (1960) Oct. (4 pp.)

Eye irritants are formed when certain mixtures of hydrocarbons and oxides of nitrogen are irradiated with near-ultraviolet light. Eye irritation is not detected in these mixtures prior to irradiation; thus, the irritants are products or intermediates of the photo-oxidation. The purpose of investigation reported was to identify the products of the reaction and to relate these products to observed eye irritation.

Recommendations on Heights for New Industrial Chimneys. G. Nonhebel. *J. Inst. Fuel 33,* 479 (1960) Oct. (33 pp.)

Engineers responsible for the design of new factories are frequently faced with difficulty in deciding the height of chimneys to disperse adequately the discharged gases and residual dust. Under the Clean Air Act, local authorities (Great Britain) must approve the height of new chimneys. Major consideration is the effect of the discharge at ground level. Formulas have been used for some years for calculating the gas concentration and rate of dust fall under normal weather conditions. From a review of available information, recommendations are now made that the height of a new chimney serving a large plant should be such that the calculated 3-minute maximum concentration of sulfur dioxide at ground level should not exceed 40 parts/100 million (by volume) in areas of heavy industry or high housing density, and 50 pphm in other areas. Similarly, the calculated maximum rate of deposit of grit and dust from a new chimney should not exceed 1000 g/100 m^2.

Total Air Pollution Emissions in Los Angeles County. R. L. Chass, P. S. Tow, R. G. Lunche and N. R. Shaffer. *J. Air Pollution Control Assoc. 10,* 351 (1960) Oct. (16 pp.)

Because of necessity, the Los Angeles County Air Pollution Control District has had to promulgate the most stringent regulations possible for sources of air contaminants as soon as sound technical and economically feasible controls had become known. With few exceptions, industrial sources have been controlled during the past decade. However, there are still three major remaining areas of air pollution which must be brought under control: automobile exhaust, evaporation of organic liquids, and combustion of fuels.

Burners

Flow Pressures in Turbulent Burners with Controllable Whirl and with Free Jets Symmetrical to the Rotational Axis. H. Ullrich. *Brennstoff-Warme-Kraft 12,* 114 (1960) Mar. (4 pp. German text). (From *Appl. Mech. Rev. 13,* 767 (1960) Oct.)

After explaining the general requirements for burners for boiler furnaces, the design of a turbulent symmetrical flow burner is described where the turbulence of the primary air can be modified through the axial movement within a conical ring containing a row of stationary blades. If the behavior of symmetrical jets leaving cylindrical or conical annular nozzle with or without turbulence is considered as being frictionless this results in a straight flow of the individual particles. If jet and surroundings consist of the same medium, the exchange of momentum results in a flow toward the jet. If this flow is locally obstructed, eddies with negative pressures are created which cause a decisive modification.

From author's summary

Drying

Drying in the Pottery Industry. E. S. Moule and E. J. R. Caswell. *Gas World 152,* (Ind. and Comm. Gas Section) 72 (1960) Oct. 15 (2 pp.)

Among the increasing number of conversions that have been recently carried out are such items as stove enameling, vitreous enamel drying, bread drying, bonderizing line dryers, core drying and, in the pottery industry, mould, glaze clayware, frit and color drying. Among the most common type of dryer used in the pottery indus-

try is the central pivot type. The greater proportion of these have a reasonably satisfactory recirculating system that can be readily converted to gas firing.

Flame Research

Determination of Flame Velocities in Gaseous Predetonation. G. J. Hecht, A. J. Laderman, R. A. Stern and A. K. Oppenheim. *Rev. Sci. Instruments 31,* 1107 (1960) Oct. (5 pp.)

Application of ionization gap or "pin" probes to measure flame velocities during the development of detonation is presented. Probe construction and circuit techniques are described which, despite the widely varying character of the ionization signals in this region, yield timing precision of 2% or less for hydrogen-oxygen mixtures. Analysis of the ionization probe circuit permits the identification of the probe signal with the ionization levels encountered in the various waves generated during the development of detonation. In this manner it is possible to differentiate between shocks, flames, and detonation waves to determine the axial flame velocity profile.

Distribution of Temperature of Sooty Flames. F. Rossler. *Ann. Phys. 4,* 396 (1959) No. 6/8 (27 pp. German text). (From *Appl. Mech. Rev. 13,* 767 (1960) Oct.)

Author first establishes the relation between absorption coefficients and the wavelengths of amyl-acetate flame by a 3-term approximation. From that, the relation between the true thermodynamic temperature and the observable color temperature or the black-body temperature is formulated and presented in nomographs. Other flame types can be included by changing the parameters of the equation for the absorption coefficients.

L. S. Dzung, Switzerland

The Interaction of Weak Shock Waves with the Flame Front. G. D. Salamandra and I. K. Sevast'yanova. *Soviet Phys.-Tech. Phys. 4,* 1250 (1960) May (8 pp. Russian text); (Translation of *Zh. Tekh. Fiz., SSSR 29,* 1360 (1959) Nov. (8 pp.) by Amer. Inst. Phys., Inc.) (From *Appl. Mech. Rev. 13,* 766 (1960) Oct.)

Authors have investigated the interaction of weak shock waves with the flame front. It is shown that a detonation wave may arise during the interaction of the flame front with a weak shock wave, formed in the initial stage of the flame propagation, or it may also arise as the result of the spread of the flames through a medium which has already been prepared by shock waves, formed in the predetonation stage of the flame propagation. The transition from slow burning to detonation may occur as the result of self ignition of the combustion process brought about by a shock wave which has been reflected from the end of the tube.

From authors' summary

Methane-Oxygen Flame Structure. I. Characteristic Profiles in a Low-Pressure, Laminar, Lean, Premixed Methane-Oxygen Flame. R. M. Fristrom, C. Grunfelder and S. Favin. *J. Phys. Chem. 64,* 1386 (1960) Oct. (7 pp.)

Results of a study of the structure of a 1/10 atm laminar, lean, premixed methane-oxygen flame are presented in the form of profiles giving the local intensive properties as a function of distance through the flame front. Thirteen different profiles have been measured including local aerodynamics, temperature and composition. All species except atoms and radicals are included.

Methane-Oxygen Flame Structure. II. Conservation of Matter and Energy in the One-Tenth Atmosphere Flame. A. A. Westenberg and R. M. Fristrom. *J. Phys. Chem. 64,* 1393 (1960) Oct. (6 pp.)

Experimental data on temperature, composition and aerodynamic profiles through a flat, premixed CH_4—O_2 flame obtained by techniques described in the preceding paper are analyzed in terms of matter and energy conservation. The composition profiles for the seven stable species found in the flame are corrected for molecular diffusion, using diffusion coefficients measured in the laboratory, and the resulting flux distributions are shown to give a satisfactory balance of carbon and hydrogen through the flame.

Furnaces

New Plant Makes Welding Fittings Using Unique Gas Furnace Design. J. W. Abernathy. *Am. Gas J. 187,* 25 (1960) Nov. (2 pp.)

Fast forging temperatures produced by direct impingement of gas flame and radiation of furnace refractory help small plant form fittings competitively.

A Russian View . . . Radiant Heat Exchange in a Boiler Furnace Fired with Natural Gas. F. L. Kazakevitch, A. M. Krapivin, G. I. Anofriev and I. G. Vesely. *Combustion 32,* 54 (1960) Oct. (5 pp.)

Radiant heat exchange test in a boiler furnace and a comparison of the empirical values and values found by calculating the gas temperatures at the furnace exit shows that for small capacity boiler furnaces operating on natural gas, the calculation obtained by Gosenergoizdat gives thoroughly satisfactory results. The fact that in all the tests the measured temperature V_t" proved to be lower than the calculated shows that the emission properties of natural gas flame have characteristics which were not reflected in the calculated formulas.

Heat Treating

Unique Heat Treating Installation Processes 40,000 Different Parts. H. L. Hopkins. *Ind. Heating 27,* 2054 (1960) Oct. (6 pp.)

Description of hardening and tempering furnaces used to treat a wide range of parts for a large manufacturer of fasteners. Two gas generators, each having 3600 C F/hr capacity, supply atmosphere for the continuous belt hardening furnaces. The two tempering furnaces are used for temperatures up to 1000° and 1250°F, respectively. A 500 C F/hr-gas generator supplies the furnace used for the higher temperature.

Industrial Heating

Scottish Gas Board . . . Technical Advisory Service for Industry. *Ind. Gas (Brit.) 23* (1960) Oct. (7 pp.)

Many successful conversions of process plant to gas firing from other fuels have been carried out recently in Scotland. During a 12-month period, the Industrial Gas Department of the Scottish Gas Board produced 111 drawings, covering both conversions and the building of prototype equipment, together with numerous control layouts for industrial and commercial concerns. A few of these conversions are described.

Refrigeration

Refrigerant Drying Requires Considerable Time before Equilibrium Is Gained. W. O. Krause, A. B. Guise and E. A. Beacham. *ASHRAE J. 2,* 59 (1960) Oct. (5 pp.)

Little work has been done to investigate the factors affecting the time required to reduce the moisture level of a refrigerating system with desiccant-type dryers. Article presents results of studies of the effects of some of the basic refrigerating system variables on the progress of the drying action. Presented also is a practical recommendation designed to remove moisture and to protect the system against freeze-ups and formation of corrosion products.

Space Heating

Gas-Fired Hot Air "Door" Keeps Warmth In, Cold Out. M. H. Stern. *Am. Gas J. 187,* 27 (1960) Nov. (2 pp.)

It is practically impossible to prevent air from entering a heated space through an open door within the limits of practical brake horsepower ratings. But it is possible to temper this air before it causes objectionable drafts and reduces the temperature within the heated space. A system based on this principle and in use today with successful results in a modern assembly plant is described. The components are a gas-fired industrial-type furnace, air distribution system with slot type discharge openings, control system and door assembly.

LP-Gas Infra-Red Heaters Help Boost Track Attendance. W. E. Donovan. *LP-Gas 20,* 16 (1960) Nov. (2 pp.)

Management of Monticello Raceway, Monticello, N. Y., installed 150 infrared LPG-fired heaters in the grandstand to lessen the discomfort of patrons during summer evenings. Propane gas, at 10 psi, is fed from the gas installation through a 2½-in. line about 500 ft-long to the top center of the grandstand. From here, two reducing regulators drop the pressure to 11 in. The gas flows from this point into two branches feeding heaters on both sides of the grandstand through ½-mile of low-pressure piping starting at 4 in. and gradually tapering down to ½-in. at the heaters.

Ventilation

The SE-Ridge Terminal for Domestic Gas Appliances. *Gas World 152,* 614 (1960) Oct. 29 (2 pp.)

Venting of products from gas appliances into a roof space or immediately beneath an open tile in the roof ridge has been practiced for some time with reasonable success. The attractions of these methods are that the flue pipe is entirely concealed within the house, and there is no visible termination other than the open ridge tile. An installation of this kind is, however, trouble-free only if significant condensation does not occur inside of the roof or the fittings. A flue terminal has been developed by the South Eastern Gas Board (Great Britain) in conjunction with the technical staff of the Red Bank Manufacturing Co. New terminal is described.

10. EQUIPMENT AND INSTRUMENTATION

Absorption

How to Design Packed-Tower Absorbers. J. Coates and B. S. Pressburg. *Chem. Eng. 67,* 109 (1960) Oct. 31 (5 pp.)

Proper evaluation of mass transfer coefficients is fundamental in establishing height of a transfer unit and number of transfer units for packed-tower absorbers. Fundamentals of absorber design, such as rate and enthalpy balances, must be applied in preliminary calculations before the absorber can be sized. To dimension packed towers, an entirely different and more fundamental approach is followed.

Automation

Closed-Loop Computer Control at Luling. R. D. Eisenhardt and T. P. Williams. *Control Eng. 7,* 103 (1960) Nov. (12 pp.)

Monsanto's ammonia unit at the Barton Plant is now under complete full-time control of an RW-300 digital computing control system and has been operating successfully for several months. In comprehensive report, authors describe step-by-step the factors leading to this successful system. As example they describe how the system was economically justified; how ammonia is made; how the project team used plant data to develop the mathematical model; what setpoints and other factors the computer calculates; and, finally, how the team revised plant instrumentation, installed the computer, tested the computer programs, and put the computer on-line for closed-loop control.

Filters

Ceramic Fibers for Filtering Dust from Hot Gases. L. J. Kane, G. E. Chidester and C. C. Shale. *U. S. Bur. of Mines Rep. of Invest. 5672,* (1960) 18 pp.

Chemical processes using coal often require economical removal of dust from high-temperature gases. Laboratory-scale investigations have shown that an aluminum silicate fiber is suitable for filtering dust from gases at 1800°F. The effects of the bulk density of the filter, rate of gas-flow, concentration of dust in the filter, fiber diameter, depth of filter, and concentration of dust in the feed gas on removal efficiency, pressure drop, and capacity of the filter to hold dust were studied. The outstanding advantage of aluminum silicate filters is that they can be used indefinitely at 1800°F. and will not react with their environment—the dust, inert carrier gas, or the filter tube.

Fractionation

Operating Data for Low Temperature Recovery Units. D. D. Roselius and R. Wylie. *Chem. Eng. Progress 56,* 59 (1960) Oct. (6 pp.)

New data for multicomponent vapor-liquid equilibrium, performance of perforated plate ethane-ethylene splitter, and operation of low-temperature expanders, extends knowledge of operating conditions.

Heat Transfer

Exchanger Design . . . Based on the Delaware Research Program. K. J. Bell. *Petro/Chem. Eng. 32,* C-26 (1960) Oct. (14 pp.)

Cooperative research program on baffled shell and tube heat exchangers at the University of Delaware carried out experimental and analytical studies on the shell-side phenomena in heat exchangers for more than 12 years. Chief result was the accumulation of a large amount of carefully obtained experimental data. Surveying the various design contributions, author has selected a few pieces and assembled them in a coherent form. This is the first time that the Delaware project has suggested a design procedure encompassing all of the usually encountered shell-side features of an exchanger.

How to Design a Multiple Component Partial Condenser. D. J. Ward. *Petro/Chem. Eng. 32,* C-42 (1960) Oct. (7 pp.)

Partial condensation of a mixture of vapors by cooling is among the most common refinery heat transfer operations. Stripper overhead condensers, stabilizer condensers, etc., involves multiple components which are distributed in some manner between both condensate and vapor streams. There have been a number of articles devoted to development of practical and theoretical partial condenser design procedures. However, because heat and mass transfer must be treated simultaneously, these methods are so complicated that they are necessarily limited to mixtures involving only one or two condensable components. In current article the relationships provided do not involve the usual trial and error mass and heat transfer calculations.

Piping

Forged Steel Flanges. E. F. Harrington. *Air Conditioning, Heating and Ventilating 57,* 89 (1960) Oct. (7 pp.)

Knowledge of the various types and classes of flanges, plus the ability to judiciously apply the right one to a given pipe line or pressure vessel, can mean reduced installed costs and improved system performance. Article reviews flanges and facings, with an emphasis on proper application that tells why as well as where.

Reactors

Control Design. T. J. Williams. *Chem. Eng. 67,* 181 (1960) Oct. 17 (6 pp.)

Equation presented of a single-capacity system contains a first-order transfer function. In the term T_1 is the time constant of mixing in the kettle and has units of time equivalent to those used in expressing flow rate into and out of the kettle. Many dynamic processes in engineering can be considered single-capacity systems, expressible as first-order transfer functions. Common consideration is that each has only one "place" for storage of material within the system.

How to Select Pressure-Vessel Size. R. R. Maccary. *Chem. Eng. 67,* 187 (1960) Oct. 17 (4 pp.)

Practical approach to aid in sizing pressure vessels for economical dimensions or to get the optimum size for a vessel having minimum surface area.

11. MATERIALS OF CONSTRUCTION, AND CORROSION

Alloys

Characteristics of Heat Resistant High Alloy Castings Related to Industrial Applications. E. A. Schoefer. *Ind. Heating 27,* 2117 (1960) Oct. (9 pp.)

Heat-resistant castings that have very low scaling rates are available in a wide series of iron-chromium-nickel alloys and are generally used under conditions where the metal temperature is in excess of 1200°F. Selection of a particular alloy, of course, is dependent upon the application, and article discusses composition, structure and properties for the various grade of cast heat-resistant alloys in relation to applicability.

Cathodic Protection

Cathodic Protection Criteria. W. von Baeckmann and G. Heim. Part 1. *Gas- u.-Wasserfach 101,* 942 (1960) Sept. 9 (6 pp. German text); Part 2. *Ibid.,* 986 (1960) Sept. 23 (9 pp. German text)

Since the methods studied in Part 1 on measurements of current density and current demand give apparatus difficulties due to voltage absorption, there remains as the safest criterion the determination of the potential at the phase boundaries of metal and electrolyte. The dangerous pitting of especially the thin-walled holders and pipes, which results through the action of the macrocorrosion cells, makes it necessary to polarize the open circuit up to the potential of the anode. Then the corrosion current measured in the outer circuit is zero and the macrocell action is stopped. The control measurement of the protection potential must follow as far as possible that of the protected surface, which, however, is not possible with buried installations. It is shown that the station perpendicularly over the pipe axis possesses the least deviation of earth potential (in the immediate vicinity of the pipe). Moreover the voltage decrease in the soil is to be considered, which, by homogenous nature and symmetrical distribution, permits calculation by formula of the current density.

An Improved Method of Locating Underground Pipeline Shorts. *Gas 36,* 69 (1960) Nov. (4 pp.)

Newly developed search technique and apparatus looks for the disturbance of a null and therefore gives a sharp

indication of the location of a short. The basis of this improved technique is the fact that when audio current flows in a conductor (such as pipe), a field is created around the pipe and at right angles to it. When the field is intercepted by an inductor, current will flow in it. If the inductor is held in the same plane as the pipe and moved over it, the induced field is cancelled when the inductor is immediately over the pipe. This happens only when relatively high current flows in the pipe.

Corrosion

Anhydrous Ammonia Can Halt Internal Casing Corrosion. R. C. Loncaric, D. R. Anthony, M. D. Folzenlogen and F. Calvin. *Oil Gas J. 58,* 117 (1960) Oct. 24 (4 pp.)

Description of how a major producer of crude oil stopped internal casing corrosion at a fraction of the cost of a well repair job. Averaging only $50 per well per year, this method is simple and nonhazardous.

Corrosion Problems in a Refinery Diethanolamine System. K. L. Moore. *Corrosion 16,* 503t (1960) Oct. (4 pp.)

Various corrosion problems are described which have occurred in a large diethanolamine (DEA) system that removes hydrogen sulfide from refinery gas streams and a liquid propane-butane stream. These include reboiler corrosion, rich DEA corrosion, stress cracking, and erosion. The effects on system operation are discussed, as well as the means of minimizing the problems. Electrical resistance measuring device data indicate the importance of keeping the solution loading below 0.34 mol of acid gas ($H_2S + CO_2$) per mol of DEA to minimize the corrosion in the rich DEA. Data from this source also show the relationship between general reboiler corrosion and solution contamination.

Corrosion by Urban Cooling Waters. S. Sussman. *Corrosion 16,* 471t (1960) Oct. (2 pp.)

Untreated recirculating cooling waters are likely to become corrosive when low alkalinity waters are present in an area where there is a relatively high sulfur dioxide air content. Untreated circulating cooling waters are compared with makeup waters for eight Eastern cities for such factors as *p*H, alkalinity, chloride content, sulfate/chloride ratio, and corrosion products. New York City water is discussed specifically. Corrosion can be mitigated by alkaline *p*H adjustment with maintenance of satisfactory chromate concentrations.

Estimating the Cost of Corrosion in Refinery Crude Units. N. J. Landis. *Corrosion 16,* 479t (1960) Oct. (8 pp.)

Cost of corrosion was estimated for refinery crude oil distillation units as the first step in determining the cost of refinery corrosion on a unit throughput basis. A knowledge of the overall cost is regarded as a valuable aid in assigning manpower and facilities most effectively to corrosion work. Capital, maintenance and operating costs were all considered. A significant result of this study was that the actual cost of corrosion was far less than prior estimates by the industry would have predicted. Of equal importance are the methods evolved in gathering and analyzing the various types of data. In their general form these methods should be applicable in corrosion cost studies for all types of process units.

Graphite

Progress in Development of Pyrolitic Graphite at General Electric Company. *Ind. Heating 27,* 2200 (1960) Oct. (3 pp.)

Pyrolitic graphite, in addition to its ability to withstand high temperatures, is also stronger and more resistant to oxidation than ordinary graphite. In addition to military applications, it can be utilized by industry as a strong, smooth-surface material for hot-pressing dies, and as a heat-resistant material in melting crucibles for metals, ceramics and semiconductors. It may also prove useful in nuclear reactors, in which graphite is used to slow down neutrons.

Inhibitors

Cooling Water Inhibitor Performance. P. R. Puckorius and W. J. Ryzner. *Corrosion 16,* 473t (1960) Oct. (7 pp.)

Corrosion inhibitors in open recirculating cooling water systems require rapid and complete film formation for maximum effectiveness. The protective film is established on clean surfaces by initial treatment with inhibitor at high dosage levels. Protection then can be maintained by continuous treatment at substantially lower levels. If operational difficulties should cause loss of the protective film, low-level treatment after the film has been lost may result in severely increased corrosion and deposition. Laboratory corrosion, deposition and consumption studies with polyphosphate- and chromate-based inhibitors illustrate the advantages of high level startup and low-level maintenance treatments. These data are confirmed by actual field experiences.

Insulation

Thermal Conduction and Its Special Application to Thermal Insulation. H. K. Suttle. *Chem. Process Eng. 41,* 461 (1960) Oct. (4 pp.)

Theories of transient heat conduction are considered. Appropriate equations are derived and their use in graphical form demonstrates the solution of many conditions during unsteady-state heat transfer. Two appendices containing worked examples illustrate the application of various theoretical equations derived in the article in determining optimum insulation.

Metals

Low Temperature Metals: A Roundup. G. H. Zenner. *Chem. Eng. 67,* 117 (1960) Oct. 31 (4 pp.)

Common metals in cryogenic service today are compared. The superinsulations that help contain ultralow-temperature fluids are discussed briefly, and some pieces of cryogenic equipment are described.

Plastics

New Plastic Pipe Passes Field and Lab Tests. J. C. Lehr and R. B. Orr. *Oil Gas J. 58,* 89 (1960) Oct. 17 (3 pp.)

Delrin acetal resin pipe makes new applications possible through improved properties not previously available to the petroleum industry. Pipe shows high strength while exposed to sour crude, a high resistance to fatigue, and a high impact strength. A comprehensive laboratory test program is under way to obtain long-term design-strength data on this new product. Research programs are being expanded to better define the causes and effects of paraffin buildup.

Plastic Ventilation Products. H. M. Englund. *Air Conditioning, Heating and Ventilating 57,* 75 (1960) Oct. (10 pp.)

Types and uses of plastic pipe have been the subject of a good deal of literature during the past few years and are quite well known. Not so familiar, however, are the various types and uses of plastics in corrosive exhaust installations. Article provides an introduction to these plastic ventilation products and their varied industrial applications.

12. ANALYTICAL METHODS AND TESTS

Chromatography

Acoustical Apparatus for Gas Detection. C. F. Robinson (assigned to Consolidated Electrodynamics Corp.) U. S. 2,952,153 (1960) Sept. 13.

Gas analysis apparatus is claimed in which the components of the gas mixture are separated by chromatography. These are quantitatively detected by the difference in acoustic frequencies of two hollow resonator cores. Carrier gas is passed through the first resonator core and the test gas then is added to the stream, passed through the chromatograph and the separated components are successively carried through the core of the second resonator. Each resonator emits a signal of distinctive acoustic frequency, and the difference in frequency is integrated against a time scale on a recorder.

Optimum Conditions for Separation in Gas Chromatography. J. C. Giddings. *Anal. Chem. 32,* 1707 (1960) Nov. (5 pp.)

Variables that influence chromatographic separations are mathematically criticized and optimum conditions established. Mathematical equations are devised for each variable in regular and capillary column chromatography. The factor of analysis time is considered.

Dust Determination

For "White Rooms," Latest Methods of "Fingerprinting" Airborne Dusts. D. P. Hoffman. *Air Eng. 2,* 51 (1960) Oct. (5 pp.)

It is often helpful to trace the source of dust that troubles a "super-clean" area, to stop dirt at point of emission. Article tells how to identify and track down these dust particles on a "do-it-yourself" basis.

Hydrogen

A Method for Detecting Hydrogen in Gas Mixtures. J. R. Young and N. R. Whetten. *Rev. Sci. Instruments 31,* 1112 (1960) Oct. (3 pp.)

Selective diffusion of hydrogen in palladium has been employed to determine the presence of hydrogen qualitatively and quantitatively in different gas mixtures. It was found possible to determine concentrations of hydrogen from 100% to 0.001%, or about 10 ppm, in nitrogen, with ease. Also it was found possible to detect the presence of hydrogen at a partial pressure of 10^{-7} mm Hg. This would indicate that it is possible to determine the presence of hydrogen in concentrations of one part in 10^{10} in a gas at atmospheric pressure. There is reason to believe that this technique could be extended even further perhaps to one part in 10^{14} with proper care and presently existing high vacuum techniques.

Olefins

Some Refinements in the Correlations of the Raman Spectra with Molecular Structures for Acyclic Mono-olefinic Hydrocarbons. D. G. Rea. *Anal. Chem. 32,* 1638 (1960) Nov. (14 pp.)

Spectra are recorded with a Cary Model 81 photoelectric recording spectrometer. Particular attention is paid to the symmetric deformation band of the CH_3 groups attached to the double bond and to the alpha carbon atoms, as well as to the C=C stretching band itself.

Thermogravimetric Methods

Differential Thermal Analysis by the Dynamic Gas Technique. R. L. Stone. *Anal. Chem. 32,* 1582 (1960) Nov. (7 pp.)

Apparatus is described for variable control in differential thermal analysis. This dynamic gas method controls the reaction variables, temperature, pressure, and gas composition. During any particular run, the variables are controlled individually or collectively to indicate variable effects on the reaction. Thermograms are given for such reactions as oxidation, thermal decomposition, crystallographic inversion, and others.

Thermogravimetic Measurements. A. E. Newkirk. *Anal. Chem. 32,* 1558 (1960) Nov. (6 pp.)

Dynamic thermogravimetric measurements are subject to errors and limitations not easily recognized. These include the effect of changing air buoyancy and convection, the measurement of temperature, atmospheric effects, heating rate and heat of reaction. The technique is limited to determine quantitative behavior of a system and not precise constants.

Thermogravimetry in Self-Generated Atmospheres. P. D. Garn and J. E. Kessler. *Anal. Chem. 32,* 1563 (1960) Nov. (3 pp.)

Thermogravimetric procedure is modified to permit the reaction to proceed in an atmosphere generated by the sample without increasing the pressure. The modification affords greater clarity of thermogravimetric curves and accurate estimation of decomposition temperature.

13. BASIC SCIENCE

Adsorption

Adsorption of Hydrocarbon Gases and Their Mixtures. V. G. Fastovskii and A. E. Rovinskii. *Zh. Prikladnoi Khimii. 33,* 1641 (1960) No. 7 (13 pp. Russian text)

Adsorption isotherms of CH_4, C_2H_2, C_2H_5, C_2H_6, and C_3H_6 at 0-20° and C_3H_8 at 0-80° on activated carbon, and also C_2H_6 at 20° on silica gel at $p<760$ mm Hg were found to be satisfactorily described by the potential theory of adsorption.

Assoc. Tech. Services, Inc.

Carbon Dioxide

Photolysis of Carbon Dioxide. B. H. Mahan, *J. Chem. Phys. 33,* 959 (1960) Oct. (7 pp.)

Vacuum ultraviolet photolysis of carbon dioxide has been investigated. Kinetic data and quantum yield measurements indicate that electronically excited oxygen atoms are produced in the primary process at 1470 A and at 1236 A. Such a primary process is consistent with the tentative spectral assignments which have been made for carbon dioxide.

Chemisorption

The Chemisorption of Carbon Monoxide on Metals. R. A. Gardner and R. H. Petrucci. *J. Am. Chem. Soc. 82,* 5051 (1960) Oct. 5 (3 pp.)

Adsorbed species resulting from the chemisorption of carbon monoxide on copper oxide, nickel and cobalt were studied by infrared spectroscopy. An infrared technique developed by Eischens was used to obtain the spectra. The observations made in the investigation serve to support and extend the Wolkenstein hypothesis of the mechanism of chemisorption. Surface atoms can act as strong or weak electron donors and acceptors; the adsorbed species assume the opposite role. Adsorbed carbon monoxide species displayed vibration frequencies corresponding to the possession of non-integral numbers of electrons ranging from $(CO)^{+0.70}$ to $(CO)^{-1.80}$ with absorption bands from 2173 to 2000 cm^{-1}.

Fluid Flow

Concentration Distribution in Two-Phase Pipe Flow. S. L. Soo and J. A. Regalbuto. *Can. J. Chem. Eng. 38,* 160 (1960) Oct. (7 pp.)

Concentration distribution of solid particles in two-phase turbulent pipe flow was studied. Because of the inertia of solid particles, transport of solid particles across the velocity field of the turbulent stream by turbulent diffusion results in deceleration of particles in the region near the wall by the stream and acceleration of particles transported toward the high velocity core. In the core, the particles have lower mean velocity than the stream while near the wall the mean particle velocity is higher. This gives rise to a nonuniform distribution of solid particles in fully developed turbulent pipe flow. Experimental determination of concentration distribution was made with an impact disk particle counter system.

Fundamental Aspects of Solids-Gas Flow. Part 4. The Effects of Particle Rotation, Roughness and Shape. L. B. Torobin and W. H. Gauvin. *Can. J. Chem. Eng. 38,* 142 (1960) Oct. (12 pp.)

Various complicating effects which rotation, surface roughness and shape impose on the motion and drag of single particles entrained in a fluid are examined. In general, rotation appears to have little effect on the drag coefficient at low Reynolds Numbers, but influences the linearity of the motion and may thus play a part in the mechanism of particle entrainment in conveyed solids-gas systems. Negative lift has been observed in the critical Reynolds Number region as the result of asymmetry in the wake structure. Surface roughness will cause an early transition to a turbulent boundary layer at higher *Re* values, which will result in an appreciable decrease in drag coefficients, but it may increase the drag at low Reynolds Numbers. The effect of particle shape is more complex than has been suggested by previously published analyses.

Wave Resistance in Long Gas Pipe Lines. E. Kh. Odel'skii. *Izv. Vyssh. Uchebn. Zavedenii, Energetika,* 81 (1958) No. 4 (3 pp. Russian text); *Ref. Zh. Mekh.* (1959) No. 6 (Rev. 6161). (From *Appl. Mech. Rev. 13,* 752 (1960) Oct.)

Motion of a gas in a conduit of sufficient length is associated with the appearance of a wave resistance governed by the presence of inertia forces with accelerated motion of the gas. A relation is obtained which permits the determination of the correlation between the wave and the full resistance on the assigned section of the gas conduit. It was shown that for 90% of the length constituting the critical length of the gas conduit (the conditioned length of the gas conduit at the end of which the pressure is equal to zero) the wave losses were less than 1% of the full losses.

Yu. A. Lashkov
Courtesy Referativnyi Zhurnal, USSR

Kinetics

Alignment Charts for Transport Properties Viscosity, Thermal Conductivity, and Diffusion Coefficients for Nonpolar Gases and Gas Mixtures at Low Density. R. S. Brokaw. *Nat. Aero. and Space Admin. Tech. Rep. R-81,* (1960) 34 pp.

In problems involving fluid flow, heat transfer, and mass transfer of gases, the viscosities, thermal conductivities and diffusion coefficients are required. Direct measurements are time-consuming, if not impossible. Alignment charts (nomographs) for calculating the low-pressure transport properties of nonpolar gases and gas mixtures are presented. Calculations for pure gases are based on the rigorous kinetic theory of gases as applied to a realistic intermolecular force law. Mixture viscosities and conductivities are calculated from good approximations derived from rigorous theory. Properties can be calculated quickly with a precision of 2% or better.

Accuracy depends on how well the constants characterizing the intermolecular force law are known; if constants are derived from experimental data, results should be accurate to 5% or better. Force constants for 65 gases are tabulated.

Methane

The PVT Behavior of Methane in the Gaseous and Liquid States. D. E. Matschke and G. Thodos. *J. Petrol. Tech. 12,* (Tech. Note 2067) 67 (1960) Oct. (5 pp.)

PVT behavior of methane on reduced coordinates is presented, from its saturated state up to the temperature $T_R = 10$ and pressures of $P_R = 20$.

The Raman Spectrum of Methane. M. A. Thomas and H. L. Welsh. *Can J. Phys. 38,* 1291 (1960) Oct. (14 pp.)

The Raman spectrum of CH_4 was obtained with a spectral resolution of ~ 0.3 cm^{-1}, and rotational analyses of the ν_2 and ν_3 bands were carried out. The B_0 values obtained from the ν_2 and ν_3 bands are 5.240 ± 0.002 and 5.2406 ± 0.0011 cm^{-1}, respectively; the value of r_o determined from the latter is 1.09403 ± 0.00016 A. The rotational levels of the $v = 1$ state of ν_2 are double with B_1 values of 5.313 and 5.379 cm^{-1}. The rotational levels of the $v = 1$ state of ν_3 do not follow the theoretical formulas exactly; the deviations for the 13 branches observed can be expressed by using three different B_1 values, 5.178, 5.195 and 5.212 cm^{-1}. The band origins are: $\nu_1 = 2916.7$; $\nu_2 = 1533.6$; and $\nu_3 = 3018.9$ cm^{-1}.

The Reaction of Ozone with Methane. F. J. Dillemuth, D. R. Skidmore and C. C. Schubert. *J. Phys. Chem. 64,* 1496 (1960) Oct. (4 pp.)

Reaction of ozone with methane was studied in temperature-controlled, infrared gas cells. Infrared analysis showed the major reaction products to be carbon monoxide, carbon dioxide, formic acid and water vapor. It was found that the reaction was substantially independent of Pyrex and sodium chloride surfaces. The activation energy was calculated to be 15.3 kcal/mole with oxygen as the ozone diluent. When oxygen was excluded from the reaction mixture of methane and ozone, a value for the activation energy of 13.9 kcal/mole was found.

Propane

Photosensitized Oxidation of Propane with X-Rays. W. H. Clingman, Jr. *Ind. Eng. Chem. 52,* 915 (1960) Nov. (4 pp.)

Photosensitized oxidation of propane with high-energy radiation has been investigated as a selective process for producing propyl alcohols and acetone. The reaction takes place at room temperature over zinc oxide under the influence of gamma radiation. Acetone, ethyl alcohol, n-propanol, and 2-propanol are the initial products formed, while aldehydes and acids are absent. These initial products react further as irradiation continues. Propane conversion is a linear function of radiation dose after an initial line-out period. With at least one form of zinc oxide, pressure and temperature have little effect on conversion.

Shock Waves

Physical Investigation of Gases by Means of Shock Waves. R. I. Soloukhin. *Uspekhi Fiz. Nauk 68,* 513 (1959) June (16 pp. Russian text.) (From *Appl. Mech. Rev. 13,* 758 (1960) Oct.)

Review deals with: choice of method for producing and using shock waves; thermodynamic properties of air and other gases at high temperatures; propagation of shock waves in relaxing gases; investigation of chemical reactions in gases at a shock wave; spectroscopic investigation of the gas state at a shock wave; thermodynamic equilibrium on ionization at a shock wave.

R. F. S. Hearmon
Courtesy of Physics Abstracts

Temperature Measurements of Shock Waves by Spectrum-Line Reversal. Parts 1 and 2. J. G. Clouston, A. G. Gaydon, I. R. Hurle and I. I. Glass. *Proc. Roy. Soc. Lond. (A) 248,* 429 (1958) Dec. (16 pp.); *252,* 143 (1959) Sept. (12 pp.) (From *Appl. Mech. Rev. 13,* 759 (1960) Oct.)

Time-resolved measurements of temperature in the flow of air, N_2, and O_2, following normal shock waves are made by the line-reversal method, where sodium or indium are added as the active impurities. By using a null method, the results are made independent of impurity concentration, and temperature histories are determined to about $\pm$ 20°C. Measurements are normally limited to maximum brightness temperature available in the light source used, though somewhat higher temperatures can be measured with some loss in accuracy. Temperatures up to 3600°K are determined in N_2 using a carbon arc source and indium blue line reversal.

C. F. Hansen, USA

Thermodynamics

Applied Hydrocarbon Thermodynamics. Part 22. Fugacities for Components of Vapor Mixtures. W. C. Edmister. *Petrol. Refiner 39,* 167 (1960) Oct. (6 pp.)

It was previously shown that the vapor-liquid phase equilibrium ratio depends upon the fugacities of each component in both liquid and vapor phases. Both of these fugacities can be computed from PVTC (pressure-volume-temperature-composition) data by thermodynamic equations. At this point fugacity and activity coefficient of the components of the equilibrium vapor phase are of interest. Fugacities are calculated from PVTC data, which may be correlated by graphical or analytical equation methods. Some of the equations of state are explicit in pressure, rather than volume. This requires a different thermodynamic relationship for the fugacity.

Vaporization

Graphical Estimation of Energies of Vaporization. R. J. Marcus. *Ind. Eng. Chem. 52,* 938 (1960) Nov.

Graphical determination of energies of vaporization of liquids is presented. It only requires knowledge of boiling point and molar volume of the liquid, and has been tested over a temperature range of 77°-2500°K.

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Publications Abstracted for GAS ABSTRACTS

Air Conditioning, Heating and Ventilating
Air Engineering
Air Pollution Control Association, Journal of
American Chemical Society, Journal of
American Gas Association Monthly
American Gas Journal
American Institute of Chemical Engineers, Journal of
American Society for Testing Materials Bulletin
American Society of Mechanical Engineers, Transactions of
Engineering for Power, Journal of (Series A)
Engineering for Industry, Journal of (Series B)
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Basic Engineering, Journal of (Series D)
Applied Mechanics, Journal of (Series E)
Analytical Chemistry
Appliance Manufacturer
Applied Chemistry, Journal of
Applied Mechanics Reviews
Applied Physics, Journal of
Applied Spectroscopy
ARS Journal
ASHRAE J.
Australian Journal of Applied Science
Australian Journal of Chemistry
Battelle Technical Review
Bituminous Coal Research
Brennstoff-Chemie (German)
British Coal Utilization Research Association *Monthly Bulletin* and *Quarterly Gazette*
Business Week
Butane-Propane News
California Oil World
Canadian Chemical Processing
Canadian Gas Journal
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Canadian Journal of Chemistry
Canadian Journal of Physics
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Cost Engineering
Datamation
Design News
Drilling
Electronics
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Gas
Gas Age
Gas & Oil Power (British)
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Gas Industries
Gas Journal (British)
Gas Service and Domestic Coke
Gas Times (British)
Gas- und Wasserfach (German)
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Heating, Piping & Air Conditioning
Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing (British)
Industrial Gas (American)
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Industries du Gaz, Journal des (French)
Institute of Fuel, Journal of (British)
Institute of Gas Technology Research Bulletins
Institute of Petroleum, Journal of (British)
Institution of Gas Engineers Bulletins and Communications (British)
Instrumentation
Instruments and Control Systems
Izvestiva Akademii Nauk S. S. S. R. Otdelenie Khimicheskikh Nauk (Russian)
Khimiya i Tekhnologiya Topliva i Masel (Russian)
LP-Gas
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Petro/Chem Engineer
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Research/Development
Research, Journal of, A. Physics and Chemistry
Research, Journal of, B. Mathematics and Mathematical Physics
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Review of Scientific Instruments
Revue Generale du Gaz (Belgian)
Rivista dei Combustibili (Italian)
Science
Scientific & Industrial Research, Journal of, A. General (India)
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Technical News Bulletin
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